MNEMONIC AND NONMNEMONIC SCIENCE VOCABULARY INSTRUCTION WITH MILDLY HANDICAPPED STUDENTS

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1989

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by

Margaret Elaine King-Sears

This work is dedicated to the memories of two people. First, to the memory of my youngest sister, Susan, who inspired me to see the unique, loving, and intriguing qualities of special people. Second, to the memory of my grandmother, Lucille Sutliff, who inspired me to believe in myself by her model of persistence, independence, and substance for life that few people achieve.

ACKNOWLEDGMENTS

Expression of appreciation for people who have helped me to attain the goal of earning this degree is appropriate at this time. An added statement seems necessary; not only have I realized the depth and breadth of my capabilities, but I have also realized the depth and breadth of those who have supported and encouraged me.

My parents, Joseph and Mary King, never wavered from their support, in every respect, of my abilities to achieve this goal. My nine siblings also gave me encouragement. I am fortunate to be a part of this family.

I would like to thank my committee members, Cecil Mercer, Paul Sindelar, Bill Reid, Lee Mullally, Vivian Correa, and Susan Peterson. Each person provided me with professional feedback and support, as well as valuable direction throughout my coursework. Special thanks go to my chairman, Cecil Mercer, who spent much time with me, offering encouragement, suggestions, and sharing his professional expertise. His sense of humor and patience have been both inspiring and helpful.

Margo Mastropieri from Purdue University, who has conducted the majority of the research with mnemonics, was

often available to offer direction and advice. My contact with her has been motivating and encouraging.

The special education office staff and other faculty members have also been supportive. I have appreciated their willingness to assist me during this research and also during my years at the University of Florida.

This research would not have been possible without the efforts of the teachers who implemented the interventions that were investigated in this study. I thank Donna Kidwell from Lincoln Middle School, Susan Povey from Westwood Middle School, and Dollean Watson from Mebane Middle School for their cooperation. I also thank their students for their participation in this research. In addition, Jan Benet from the Exceptional Student Education Department of Alachua County Schools was instrumental in helping me to conduct this research in the schools.

My colleagues, Stephanie Carpenter, Jolenea Stoutimore, Chuck Evans, and Kim Stoddard, were both supportive and helpful when I needed those kinds of encouragement. I am grateful to Stephanie who helped me with the reliability measures of this research. I thank Dave Miller and Addison Watanabe for their valuable assistance with the data analysis.

The two graduate students who scored the subjects' papers became more than students who were working with me.

Laura Risi and Lisa Eaton became my friends, and I have benefited from the support they gave me.

There are many friends and former colleagues, too numerous to name, that have offered personal and professional encouragement to me. I appreciate their friendship and support during this time. In particular, the memory of Karen Moody Fechtel will always be a reminder to me of the strength and support one experiences from a friendship.

Finally, a very special thanks is extended to my husband, Michael. I thank him for being my helpmate.

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August 1989

Chairman: Cecil D. Mercer
Major Department: Special Education

The purpose of this study was to compare mildly handicapped subjects' recall of science vocabulary definitions among three treatments during an acquisition, short-term retention, and long-term retention stage. The subjects were instructed using a nonmnemonic systematic teaching method, a teacher-provided keyword mnemonic method, or a subject-provided keyword mnemonic method. Subjects' recall was measured with both a written and a matching assessment. Results were analyzed with the analysis of covariance procedure (the covariate was the subject's Intelligence Quotient) and repeated measures.

No significant differences for treatment methods were found for the written assessments. Significant differences were found on the matching assessments for the

teacher-provided keyword mnemonic method and for the subject-provided keyword mnemonic method during acquisition and short-term retention stages. These results have educational implications for mildly handicapped students who are required to learn definitions of unfamiliar vocabulary words.

CHAPTER I
INTRODUCTION

Teachers of mildly handicapped (specific learning disabled and emotionally handicapped) students have revised teaching techniques as researchers and educators have developed improved interventions for these students. Commonly accepted theories of education for specific learning disabled (SLD) and emotionally handicapped (EH) students from the past have been rejected for more effective and efficient instructional methods.

Professionals have witnessed a shift in emphasis from how SLD students process information to an emphasis on the use of effective and efficient instruction (Kavale & Forness, 1987). McKinney (1983) noted that the research from the SLD institutes promoted teaching students learning strategies. In this movement trainers emphasized cognitive and metacognitive strategies. Flavell (1981) defined cognitive strategies as those that contribute to performance. Metacognitive strategies monitor performance: that is, strategies that reflect thinking about thinking. In addition, the emphasis for EH students has changed from a medical/psychoanalytical (Morse, 1977) approach to helping

the students become more accountable and aware of their behaviors by teaching students methods such as self-control techniques. These self-control techniques can result in students becoming more independent learners and managers of their educational environment in both behavioral and academic areas (Hughes, Ruhl, & Peterson, 1988). Moreover, effective educational programs for mildly handicapped students, regardless of their exceptionality label, are critical to ensure academic success (Scruggs & Mastropieri, 1986).

Teaching students how to use a strategy (i.e., how to learn) is a cognitive skill, and using strategies has helped secondary mildly handicapped students to achieve in school (Schumaker, Deshler, Alley, & Warner, 1983). Students who are mildly handicapped do not typically use strategies to learn academic information; thus, instructing them in the use of strategies appears necessary for them to experience success in school (Ellis & Lenz, 1987; Shepherd, Gelzheiser, & Solar, 1985).

Mastering learning strategies enables mildly handicapped students to experience success with assignments in both regular and special education classrooms. These assignments require skills in areas such as writing, comprehending reading passages, and identifying words. Students who learn and use a strategy improve their grades in school (Deshler & Schumaker, 1986). In addition, students

who acquire knowledge of strategies can use them in situations other than those occurring in school. For example, a writing strategy not only improves students' performance with written school assignments, but also enables the students to fill out job application forms.

One strategy that may be employed by mildly handicapped students is mnemonics. Bellezza (1981) defined mnemonics as learning strategies that can improve the initial learning and later recall of information. Learning disabled and emotionally disturbed students have been successfully taught the meaning of unfamiliar vocabulary using the keyword method of mnemonics (Mastropieri, 1988; Mastropieri, Emerick, & Scruggs, in press).

There are two components to the keyword method of mnemonics. The first component is the acoustic link that connects the familiar word (the keyword) and the unfamiliar word by a similar sound between the two words. The second component is the imagery link that is a picture of the definition of the unfamiliar word that interacts in some manner with a picture of the keyword.

Atkinson (1975) referred to the keyword mnemonic method as the "three Rs." The three Rs involve a systematic Recoding of an unfamiliar word using a keyword, Relating the keyword to the unfamiliar word's definition, and Retrieving the definition of the previously unfamiliar word by using the

keyword's relation to the new word's definition. For example, the term "fjord" (which is a stream with steep hills on either side) is recoded as "board," and the two words are related by using a picture, or an interactive illustration, of a board connecting the two steep hills on either side of the stream. When a student is required to give the definition of fjord, the recoded keyword (board) is a prompt for the student to relate the term to the interactive illustration (a board over a fjord), which elicits retrieval of the definition of a fjord (Fox, King, & Evans, 1987).

The above example of "fjord" not only is an explanation of the keyword method, but also is an indication of the type of vocabulary that secondary school students are required to learn. Low-usage vocabulary words, such as those terms found in social studies, science, and geography content areas, are more problematic for mildly handicapped students. The vocabulary itself may be new to the students, and the words may not be frequently used in everyday life. Yet, to succeed in those classes, the students must learn the meaning of the vocabulary.

The majority of initial research with the use of the keyword mnemonic method to teach vocabulary meaning has been done with foreign language words taught to nonhandicapped students. Higbee (1979) found that students who made up their own mnemonic keyword were more likely to retrieve the

definition. In addition, investigators have found that nonhandicapped students learned and retained more vocabulary definitions when these students were instructed in how to use the keyword method (Pressley, Levin, Kuiper, Bryant, & Michener, 1982).

More recently, investigators have expanded the research of the keyword mnemonics method to the handicapped population. In the majority of these studies, special education students have been provided with the keyword and the interactive illustration (e.g., Mastropieri, Scruggs, & Levin, 1986; Veit, Scruggs, & Mastropieri, 1986). This is an imposed keyword method because the keyword and interactive illustration have been provided for the student.

Levin (1976) stated that an imposed keyword mnemonic strategy may be necessary for students who are younger than 6 or 7 years of age. These students can effectively use a keyword and interactive illustration that the experimenter has provided. However, past this developmental age students should be encouraged to provide their own keyword and to imagine their own interactive illustration. One advantage of the induced keyword (i.e., the keyword and interactive illustration have been made up by the student) is that the student is actively involved in the process of learning.

In addition to the possibility that the researchers' imposed keywords may not be familiar words for students, the

provision of a keyword and an interactive illustration for the students does not encourage the students in the independent use of the keyword method of mnemonics. An induced keyword method that requires the students to make up their own keyword and imagine an interactive illustration would more likely result in independent learning.

A cost consideration is also apparent. The time and money spent to make up the keywords and print the interactive illustrations could be eliminated if students could be taught to make up their own keywords and imagine an interactive illustration. It is, however, possible that the students may not initially be capable of providing their own keyword, and must be taught the use of a keyword strategy (McLoone, Scruggs, Mastropieri, & Zucker, 1986).

Statement of the Problem

The purpose of this study was to compare the vocabulary definition recall of mildly handicapped students among three instructional conditions. The three conditions were (A) systematic teaching, (B) systematic teaching with a teacher-provided (imposed) keyword mnemonic, and (C) systematic teaching with a subject-provided (induced) keyword mnemonic. Measures of students' recall of definitions from memory (by writing the definitions) and recognition (by matching the words to their definitions) were obtained on a weekly basis

following instruction to determine and compare acquisition, short-term retention, and long-term retention of definitions among the three conditions. In addition, measures were obtained on a daily basis immediately after each instructional day to determine and compare rate of acquisition of the definitions taught each week.

The following experimental questions were asked for the three treatment groups:

1. Does the recall of subjects' acquisition of definitions during instructional implementation differ?

2. Does the recall of subjects' short-term retention 1 week following instructional implementation differ?

3. Does the recall of subjects' long-term retention 3 weeks following instructional implementation interventions differ?

The problem this investigator examined is important for several reasons. First, mildly handicapped students are required to learn definitions of words that are unfamiliar to them, and these students typically have memory problems (Torgesen, 1980). Second, these students typically do not utilize a strategy to help them experience success with academic tasks unless that strategy is taught to them (Deshler & Schumaker, 1986). Third, if students can be taught to use the keyword method to learn unfamiliar vocabulary then they could be more successful learning and

remembering unfamiliar vocabulary that they need to learn for school (e.g., science class) and nonschool reasons (e.g., job-related). Finally, if the induced keyword method facilitates independent recall of definitions, then students may be able to increase their general knowledge of vocabulary definitions, improve their memory for these terms and definitions, and enhance their reading comprehension and language skills.

Rationale

In order for mildly handicapped students to experience success in school they must meet the demands of academic tasks. One of these tasks is to learn the definitions of unfamiliar vocabulary. The imposed keyword method of learning unfamiliar vocabulary has already been shown to be an effective way for students to learn and remember definitions (e.g., Mastropieri, Scruggs, & Levin, 1985a). Previous researchers have provided SLD and EH students with the keyword and interactive illustration that are the components of the keyword mnemonic method (e.g., Condus, Marshall, & Miller, 1986; Mastropieri, Emerick, & Scruggs, in press). In order for students to be able to use this method independently, they need to be able to make up their own keyword and imagine an interactive illustration.

A portion of a study conducted by McLoone et al. (1986) included a transfer task in which students made up their own keyword and imagined how the keyword could interact with the definition of the vocabulary word. This transfer task immediately followed an initial study with an imposed keyword mnemonic provided for the students. The students who were instructed using the keyword mnemonic method obtained higher scores than the students who were instructed using another method in both the initial study and the transfer study. The results of this study are an indication that students seem to be capable of making up their own keyword and using imagery to link the keyword to the vocabulary definition.

In the present study, subjects' recall of definitions was compared. The subjects were taught using one of three interventions: systematic teaching, systematic teaching with a teacher-provided keyword, and systematic teaching with a subject-provided keyword.

Definitions

The following definitions are given in order to define and clarify terms used throughout this study.

Acoustic Similarity. Acoustic similarity refers to words that are similar in sound.

Direct Instruction. This is the systematic, explicit teaching of academic strategies or tasks to students (Gersten, Woodward, & Darch, 1986).

Imagery. Imagery refers to mental images that are produced by one's memory or imagination.

Imagery Link. An imagery link is an illustration that links the keyword to the definition of the vocabulary word by using an illustration or by imagining the keyword that does something with a picture of the vocabulary word's definition.

Imposed Keyword Method. A keyword and interactive illustration is provided to the student in the imposed keyword method (Levin, 1976).

Induced Keyword Method. A keyword and interactive illustration is made up and imagined by the student in the induced keyword method (Levin, 1976).

Keyword. A keyword is a familiar, acoustically similar word that has been recoded from an unfamiliar word (Atkinson, 1975).

Learning Strategy. Learning strategies are techniques, principles, or rules that enable a student to learn to solve problems and complete tasks independently (Deshler, Schumaker, & Lenz, 1984).

Low-Usage Vocabulary. Vocabulary words that are not frequently used in common, everyday settings or situations are considered low-usage vocabulary.

Mnemonic Techniques. Mnemonic techniques are systematic procedures for enhancing learning and memory (Bellezza, 1981; Higbee, 1979).

Recoding. Transformation of unfamiliar, nonmeaningful stimuli into a more meaningful entity is considered recoding (Levin, 1983).

Relating. The integration of initially unrelated elements into a meaningful whole is referred to as relating (Levin, 1983).

Systematic Teaching. Systematic teaching is referred to in this study as the combination of effective teaching literature, including direct instruction, that states the basic format, instructional conditions, and teacher behaviors needed to ensure that students have been taught using the best available learning conditions (Engelmann, 1980; Gersten, Woodward, & Darch, 1986; Walberg, 1984).

Three "Rs". The stimulus recoding, semantic relating, and systematic retrieving of a mnemonic are considered the "three Rs" (Levin, 1983).

Delimitations

This study was delimited in several ways. First, geographically this study was restricted to Alachua County in North Central Florida. Next, subjects who were specific learning disabled or emotionally handicapped students and who were eligible for this special education placement according to federal and state guidelines were included. Finally, the subjects were attending public middle schools and receiving special education instruction from a varying exceptionality resource room teacher.

Limitations

Since this study included only learning disabled and emotionally handicapped students in the middle school grades (sixth, seventh, and eighth grades), the results should not be generalized to other handicapped, nonhandicapped, or elementary or high school students. The words selected for use in this study were tenth grade science vocabulary. The results of this study should not be generalized to other geographical areas, and the terms that were used should not be assumed to be unfamiliar vocabulary for all SLD and EH students of similar ages and grade placement. Finally, each of the three teachers who implemented the interventions of this investigation with her students taught only one of the interventions.

Summary

Mildly handicapped students are required to learn definitions of unfamiliar vocabulary terms in order to succeed with some academic tasks. However, these students typically have memory problems that hinder their academic performance when required to remember information. In addition, mildly handicapped students are considered strategy deficient and unable to effectively and efficiently improve their academic performance unless they are instructed in using a strategy.

There is a need to examine the results of successful investigations regarding the use of an imposed keyword mnemonic with SLD and EH students to determine whether students can learn an induced keyword mnemonic strategy. Students who can learn to use a strategy to make up their own keywords and imagine interactive illustrations to learn and remember definitions will have acquired a skill that they can use independently to remember word meanings for both school and nonschool purposes. Moreover, memory enhancement and vocabulary expansion may result in improved grades in school as well as an improved self-concept regarding confidence and ability to acquire and retain information.

The purpose of this study was to refine the research related to the use of mnemonics that has already been conducted with the SLD and EH population. The recall of word

definitions for the mildly handicapped students was compared in a systematic teaching condition, systematic teaching with a teacher-provided keyword mnemonic condition, and systematic teaching with a subject-provided keyword mnemonic condition. Measures of recall of definitions with both a production (written) and a recognition (matching) test were used to determine subjects' performance.

The results of this study have direct and immediate implications for teachers who require students to learn definitions of new vocabulary. Teaching students how to use the keyword method may be a more effective and efficient method of instruction when the academic task is to learn and remember meanings of unfamiliar terms.

A review of the literature relevant to this study is presented in Chapter II. The third chapter is a discussion of the methodology that was used for implementation of this study. Results and implications of this study are presented in Chapters IV and V.

CHAPTER II
REVIEW OF RELATED LITERATURE

The purpose of this chapter is to describe, analyze, and summarize existing literature related to the use of the keyword mnemonic method with specific learning disabled (SLD) and emotionally handicapped (EH) students. The criteria for inclusion of research is presented first. Next, a description of memory theories is stated. Third, an historical perspective from the literature supporting the use of keyword mnemonics with nonhandicapped populations and other mnemonic methods with handicapped populations is stated. Finally, a description and a critique of research conducted with SLD and EH students that compared the keyword mnemonic method to alternative methods is presented.

Inclusion Criteria

The following criteria were used to select the research reviewed:

1. The experimental question(s) of each study must address the effectiveness of mnemonic methods.

2. The dependent variable of each study must include recall of factual information.

3. Each study should include a complete research report of data, including description of subjects, methodology, and results.

Sources used for locating relevant literature included card catalogs at the University of Florida libraries; Current Index of Journals in Education; Educational Resources Information Center; the interlibrary loan services; the reference sections of related articles, chapters, and books; and personal communication with investigators who are currently conducting research using the keyword mnemonic method with learning disabled and emotionally handicapped students.

Historical Perspective

Memory Theory

Atkinson and Shiffrin (1968) presented two categorizations regarding memory theories. The first categorization consists of a structural, or permanent, memory and a nonpermanent, or changing, memory. This nonpermanent memory is comprised of control processes, and the outstanding feature of its nonpermanency is that the processes can be controlled by an individual according to the demands of the task to be remembered. In other words,

the way a person chooses to remember information can be modified according to the kind of instructions given, the meaningfulness of the material to be learned, and the individual's learning history or background.

The second categorization by Atkinson and Shiffrin (1968) has three components. The first is a sensory register, and information is lost from this memory in a few seconds or a shorter amount of time. The second is short-term memory, often referred to as the working memory. For example, a person would remember the information for a short period of time until the information is either no longer useful or has not been rehearsed enough to be remembered. The third component is long-term memory, and it is in this theoretical component that information is remembered for a long period of time. Indeed, the information may always "be" in long-term memory, but may not always be retrievable. An example of this is sometimes referred to as a "tip of the tongue" phenomena--the answer is known to the person but not retrievable at that moment. Traces of the answer may be available, but the answer itself may not be immediately forthcoming to the person.

In the first categorization, examples of the control processes that a person may choose to use in order to remember information are coding procedures, rehearsal operations, grouping, organizing, and chunking strategies.

In general, simple rehearsal strategies may be all that is necessary in order to retain information for a short period of time. However, more complex procedures may be necessary in order to remember information for a longer period of time. For this purpose, a coding procedure such as mnemonics can be helpful when the task is to remember information that is unfamiliar to the learner for a longer period of time.

Lorayne and Lucas (1974) referred to three basic learning skills. The first is the search for information that is typically provided by a teacher to students. The second is recall of the information, which is dependent on the student's ability to retain information. The third skill is the application of information, and that is dependent on the student's ability to use effectively the information that has been taught and remembered.

The second skill, the recall of information, is when mnemonics are beneficial. Lorayne and Lucas (1974) proclaimed that "you can remember any new piece of information if it is associated to something you already know or remember" (p. 22). These authors expanded on this statement by discussing substitute words, thoughts, or phrases for the new piece of information (e.g., a vocabulary term) as associations that link the familiar to the unfamiliar information. The linkage is dependent on

thinking of a picture that connects in some way the association with the new information.

Moreover, emphasis is placed on persons imagining their own pictures. The original picture is more meaningful to that person, and making up the picture forces the person to think about the new information and concentrate on it more than a person normally would. Lorayne and Lucas (1974) stated that simply applying the idea of mnemonics improves a person's memory due to the increased concentration on the information to be learned.

Keyword Mnemonics with Nonhandicapped Populations

Higbee (1979) stated that only a few empirical studies of mnemonics were conducted around the beginning of the 20th century. Until the revival of interest in cognition began in the 1960s, research in mnemonics was virtually extinct. Research regarding the use of mnemonics to facilitate acquisition of new vocabulary definitions began with the learning of foreign vocabulary words. Raugh and Atkinson (1975) conducted four experiments with college students comparing keyword mnemonics to other instructional strategies when teaching Spanish vocabulary. In each of these experiments, the keyword method was highly effective.

Levin, Pressley, McCormick, Miller, and Shriberg (1979) experimented with six variations comparing the keyword mnemonic method to control conditions in a classroom

setting. One concern was that when the keyword mnemonic method was applied in a classroom setting (as opposed to a laboratory setting) its effectiveness may be diminished. Levin and his colleagues did find in two experiments that high school students who were enrolled in a 2nd year foreign language class did not benefit from the use of the keyword strategy. One explanation for this was that these students were already skilled at learning new vocabulary. The researchers concluded from the results of two follow-up experiments that the benefits of the keyword method appeared to be greater for the less experienced (i.e., 1st year foreign language) student. These results prompted the researchers to conduct the final two experiments. In the final two experiments the investigators explored the possibility of developmental trends in the effectiveness of the keyword method.

The final two experiments conducted by Levin et al. (1979) involved elementary aged children. Fifth grade students who were instructed with the keyword strategy while learning Spanish vocabulary experienced dramatic learning gains. The researchers concluded that the success of the keyword method in both high school and elementary classrooms is dependent on two variables: (a) arrangement of appropriate motivational-attentional conditions, and

(b) instruction that strictly adheres to the two components of the keyword method.

Atkinson (1975) is credited with the refinement of the use of the keyword method of mnemonics. The two components of the keyword method are the acoustic keyword link to the unfamiliar vocabulary word and the imagery link that connects the keyword to the unfamiliar word's definition. The first component requires the student to associate the spoken foreign word with a familiar English word, the keyword. The second component requires the student to form a mental image (imagery) of the keyword that interacts with the English meaning. The second component is comparable to paired-associate learning.

Bransford (1979) emphasized the retrieval process of the keyword method and the dependency on the type of recall that was being tested (e.g., free recall, cued recall, recognition). In other words, the testing context for the vocabulary item would determine which organizational or mnemonic method the learner should use. Because the keyword mnemonic method relies on the retrieval of the recoded unfamiliar word that has been related to a keyword (i.e., the three Rs), the free recall method would seem to be an appropriate method of assessment for vocabulary definitions.

Atkinson's keyword method has been applied in studies with nonhandicapped populations using both foreign language

and native language vocabulary. Researchers have found that the keyword method is more effective for recalling definitions of previously unfamiliar vocabulary words than other methods such as learning the words in context or directed rehearsal (Levin, McCormick, Miller, Berry, & Pressley, 1982; Pressley, 1977; Pressley, Levin, Kuiper, Bryant, & Michener, 1982).

Mnemonics with Mildly Handicapped Populations

Bellezza (1981) noted in his review of mnemonic devices that enhancement of memory and the rate of learning in special populations may occur when mnemonic methods are used. Torgesen (1980) stated that efficient task strategies are not necessarily employed by learning disabled students--that strategies must be taught to them. To that end, a number of researchers (e.g., Deshler & Schumaker, 1986; Ellis & Lenz, 1987; Graham & Harris, 1988; Mastropieri, Emerick, & Scruggs, in press) have employed the use of a mnemonic aid to help mildly handicapped students remember strategies to use when they are required to complete various academic tasks. For example, students learn to RAP when taught a reading comprehension strategy--Read a paragraph, Ask themselves what the main idea and supporting details are, and Put it in their own words. In addition, the students are not considered proficient in the strategy's use merely because they have acquired the skill. The students

are guided through maintenance and generalization stages that help to ensure students' use of the strategy in situations other than the classroom setting in which the strategy was taught.

A number of mnemonic studies have been conducted by Mastropieri, Scruggs, and their colleagues with behavior disordered (emotionally handicapped), mentally retarded, and specific learning disabled students. Pegword, mimetic, symbolic, and variations of these mnemonics have been used to teach mildly handicapped students hardness levels of minerals, attributes of minerals, memory of prose passages, and information from chapters of history texts (Mastropieri & Scruggs, 1989; Mastropieri, Scruggs, & Levin, 1985; Scruggs, Mastropieri, Levin, & Gaffney, 1985).

The pegword mnemonic is used when teaching ordinal information (e.g., 1 is bun, and then relate bun to the information to be learned). The mimetic mnemonic consists of representational pictures in which stimulus and response information are linked. Symbolic mnemonics can be used for meaningful but abstract information in which the stimulus is represented by a symbolic picture. These mnemonic methods have been compared to questioning, free study, direct instruction, picture context, sentence-experience context, and directed rehearsal conditions. In these studies the

mnemonic method was superior to the other methods in recall of factual information.

One of the academic tasks that mildly handicapped students are required to do is to learn definitions of words that are low-usage English vocabulary. These words are more frequently used in classes such as science, social studies, and geography. However, these students typically have academic and memory problems that hinder their performance when required to remember information. In addition, these students are considered strategy deficient and unable to choose an effective and efficient way to remember unfamiliar definitions (Kauffman, 1985; Scruggs & Mastropieri, in press; Torgesen, 1979; Wong, 1988). If mildly handicapped students can be taught to use the keyword mnemonic method by using self-generated keywords (induced keyword mnemonic method) and imagining their own interactive illustrations, then they will have acquired a strategy that helps them to remember definitions of unfamiliar words.

Keyword Mnemonics with Mildly Handicapped Populations

Seven studies were located that compared the keyword mnemonic method to other methods of instruction in teaching vocabulary definitions to learning disabled and emotionally handicapped students. Three of these studies contained an additional experiment; thus, a total of ten experiments were analyzed. Aspects of keyword mnemonic research that have

been conducted with nonhandicapped populations were explored in these ten research studies to ascertain whether keyword mnemonics would be an effective method of instruction for the mildly handicapped population.

Comparisons of Keyword Mnemonics to Other Instructional Methods

Researchers who have conducted investigations on teaching vocabulary definitions using the keyword mnemonic method and other instructional methods have consistently shown that learning disabled and emotionally handicapped students learn more when the keyword mnemonic method has been employed. The keyword mnemonic method has been compared to unaided instruction, questioning, direct instruction, sentence experience context, picture context, free study, and directed rehearsal (e.g. Condus, Marshall, & Miller, 1986; Mastropieri, Scruggs, & Levin, 1985b; McLoone, Scruggs, Mastropieri, & Zucker, 1986). A description of each of these experiments is included in this chapter under Experimental Procedures.

Some researchers attempted a variation of the keyword mnemonic method that consisted of instructing students to generate their own keywords and interactive illustrations immediately after the students had participated in an experiment using the imposed keyword mnemonic method (McLoone et al., 1986). Other researchers provided the

keywords and required the subjects to imagine an interactive illustration (Mastropieri, Scruggs, Levin, Gaffney, & McLoone, 1985c). To date, these experiments are the only ones that have investigated students' independent use of a keyword mnemonic method to help them remember definitions of vocabulary.

The studies included in the following review are discussed and critiqued in terms of their research designs, subject characteristics, measurement methods, experimental procedures, materials, instructional medium, and content taught. Table 2-1 lists the investigators, subjects, interventions, and content taught to the subjects. Study results are reported and summarized.

Research Design and Description of Conditions

A group research design was used in all reviewed studies to determine the effectiveness of the interventions. Random assignment to conditions was used when possible, and stratified randomization to ensure equality of grade-level representation in conditions was used when necessary.

Eight of the ten experiments compared keyword mnemonics to one other condition. Mastropieri, Scruggs, Levin, Gaffney, and McLoone (1985c) compared keyword mnemonics to direct instruction in Experiment 1. The procedure for direct instruction was modeled from Engelmann (1980). The subjects were provided with examples and

Table 2-1. Review of Keyword Mnemonic Vocabulary Studies with Mildly Handicapped Subjects.

Investigators	Subjects	Interventions	Content
Mastropieri, Scruggs, Levin, Gaffney & McLoone (1985) - Experiment 1	32 seventh, eighth, and ninth graders	Mnemonic picture Direct instruction	Low-frequency English vocabulary
Results: The mean recall of mnemonic picture subjects was statistically higher than that of direct instruction subjects.			
Mastropieri, Scruggs, Levin, Gaffney & McLoone (1985) - Experiment 2	37 seventh, eighth, and ninth graders	Self-generated mnemonic imagery Direct instruction	Low-frequency English vocabulary-14
Results: The mean definition recall of mnemonic imagery subjects was statistically higher than that of direct instruction subjects.			

Table 2-1.--continued.

Investigators	Subjects	Interventions	Content
Veit, Scruggs & Mastropieri (1986)	64 seventh, eighth, and ninth graders	Mnemonic picture Direct instruction	Three lessons on dinosaurs: 1. identify 2. state an attribute 3. tell why extinct
Results: Mnemonically instructed subjects recalled significantly more than direct instruction subjects with the exception of the vocabulary test (1. identify), in which the mnemonic subjects' recall was higher than the direct instruction subjects' recall.			
Condus, Marshall & Miller (1986)	64 12-year-olds	Mnemonic picture Picture context Sentence-experience Context control	Vocabulary words - 5 sets of 10 words
Results: All treatment subjects recalled significantly more than subjects in the control condition. Subjects in the mnemonic condition recalled more than subjects in all other treatments across four levels of time (immediate, end of week, 2 weeks later, 8 weeks later).			

Table 2-1.--continued.

Investigators	Subjects	Interventions	Content
Berry (1987) - Experiment 1	240 subjects - fourth and fifth grade SLD nondisabled chronological-age match nondisabled reading-age match	Mnemonic pictorial keyword Mnemonic verbal keyword Definitions with pictures Definitions with sentence contexts	English vocabulary-14
Results: SLD subjects benefited more from the pictorial keyword mnemonic when compared to subjects in the other three conditions. The results of this study indicated support for two theories of SLD--developmental lag and verbal deficit.			
Berry (1987) - Experiment 2	60 SLD and non-SLD fourth graders	Pictorial keyword mnemonic Nonmnemonic picture condition	English vocabulary-20
Results: SLD subjects who had mnemonic instruction surpassed nonmnemonic nondisabled control subjects. SLD subjects' recall enhanced to a level of performance equivalent to mnemonic instructed non-SLD subjects. Delayed testing revealed that subjects maintained the benefits from the keyword method. The non-SLD subjects who learned the keyword method performed significantly better on delayed testing than the SLD subjects who had received the keyword instruction. Berry stated evidence to support process deficits in SLD subjects.			

Table 2-1.--continued.

Investigators	Subjects	Interventions	Content
McLoone, Scruggs, Mastropieri & Zucker (1986) - Experiment 1	60 SLD seventh and eighth graders	Mnemonics Directed rehearsal	Low-frequency English vocabulary-16 Italian vocabulary-16
Results: The mnemonic method was as easily trained in the SLD sample as the directed rehearsal method. The mnemonic method produced more beneficial results. In the transfer conditions, students trained in the mnemonic condition performed significantly better than subjects trained in the directed rehearsal condition.			
McLoone, Scruggs, Mastropieri & Zucker (1986) Experiment 2	60 SLD seventh and eighth graders	Mnemonics transfer task Directed rehearsal transfer task	Low-frequency English vocabulary-16 Italian vocabulary-16
Results: Subjects trained in the mnemonic condition performed significantly more than subjects trained in the directed rehearsal condition.			

Table 2-1.--continued.

Investigators	Subjects	Interventions	Content
Mastropieri, Scruggs & Fulk (in press)	25 SLD sixth, seventh, and eighth graders	Keyword mnemonics Rehearsal	Abstract and concrete English words-16

Results: Mnemonically instructed subjects performed better than subjects in the rehearsal condition on two kinds of tests. The first test required the subjects to verbally state the definitions of the words, and the second test (comprehension) required the subjects to state the appropriate word when given a novel instance of the word. Subjects performed higher on concrete items for definitions and there was no effect on the comprehension test. The experimenters concluded that the keyword method seemed to be an appropriate intervention method for addressing the specific learning characteristics of SLD subjects, especially those subjects with deficits in semantic memory.

Mastropieri, Emerick & Scruggs (in press)	8 EH subjects ages 7 - 11	Keyword mnemonic Traditional instruction	Science vocabulary

Results: Subjects were taught content of two chapters of science using the keyword mnemonic method and traditional instruction. The subjects learned more and retained more information when instructed using the keyword mnemonic method. The EH subjects also reported enjoying the keyword mnemonic method more than traditional instruction.

demonstrations, questioning during instruction, direct teaching of the vocabulary words, and practice testing of the vocabulary words. In Experiment 2, a variation of the keyword mnemonic condition was used with different subjects. Self-generated mnemonic imagery (with the keyword provided to the subjects) was compared to direct instruction in Experiment 2. In both experiments, the mean number of correct definitions for each group was compared and analyzed using a t-test.

Veit, Scruggs, and Mastropieri (1986) also compared the keyword mnemonic to direct instruction. Again, group mean percentage correct of vocabulary definitions was compared using an independent t-test.

Berry (1987) compared the keyword mnemonic condition to a nonmnemonic picture condition in Experiment 2. The nonmnemonic picture condition followed the same procedures of the keyword mnemonic condition except that there were no keywords or interactive illustrations. Berry's second experiment was a follow-up of her first experiment, and she utilized the most appropriate control condition from Experiment 1 in addition to increasing the number of vocabulary words to control for a ceiling effect. Different subjects participated in each experiment. Results from immediate and delayed recall tests were analyzed with a planned multiple t-test.

McLoone et al. (1986) used a directed rehearsal comparison condition in Experiment 1. The directed rehearsal condition was modeled from direct instruction conditions (e.g., tell the subjects the definitions and have them repeat the definitions several times). Immediately following Experiment 1, the same subjects participated in Experiment 2. In the second experiment, the subjects were required to use their respective intervention procedure from Experiment 1 independently. The second experiment was called a transfer task. The experimenters wanted to ascertain whether students could independently use directed rehearsal or make up their own keyword and interactive illustration. Again, mean percentage of correct definitions was compared using t-tests.

Another experiment that compared keyword mnemonics to one other condition was conducted by Mastropieri, Scruggs, and Fulk (in press). A rehearsal condition was used that consisted of telling the subjects the definitions, having students repeat the definitions, and providing for drill and practice of the definitions. One of the purposes of this study was to ascertain whether there was a difference in concrete versus abstract vocabulary learning in each of the conditions. A two-condition by two-item type analysis of variance test (2 X 2) was used, with repeated measures on the item type variable.

Mastropieri, Emerick, and Scruggs (in press) compared keyword mnemonics to traditional instruction (which was similar to the rehearsal condition described above). These investigators are the only ones to date who have used EH students as subjects. The subjects served as their own control, and they were taught two chapters of science using each of the interventions. An analysis of variance with repeated measures on both the intervention and retention (immediately following instruction on the 1st day, the next 2 days prior to instruction, and 1 week after instruction had ceased) was used to analyze the subjects' recall of definitions.

The remaining researchers compared four conditions. Keyword mnemonics, picture context, sentence-experience context, and a control group were compared by Condus, Marshall, and Miller (1986). Subjects in the picture context condition learned the meanings of words by studying illustrations of the definitions of the words. Subjects in the sentence-experience context condition learned the definitions of words by following two steps. The first step consisted of the students listening to and then rereading a three-sentence passage that was printed and displayed on paper. This passage contained the vocabulary word, but the definition was not stated. The subjects were expected to understand the word's meaning through the context of the

sentences. The second step consisted of the subjects answering a question about the passage. The subjects were required to relate the meaning of the word to a personal experience when they answered the question. Finally, the control condition was similar to a free-study condition. The subjects were provided with a list of words and word meanings, pencils, and additional paper, and they were instructed to choose their own method of studying to learn the definitions. A two-step analysis procedure--three-way analysis of variance (ANOVA) and analysis of covariance (ANCOVA)--was used to analyze the four-treatment condition by the two receptive-language ability by the four-time measures. That is, a 4 X 2 X 4 factorial design with repeated measures was used. A post hoc comparison (Scheffe) was used to analyze significant interactions.

In Berry's (1987) first experiment, the keyword mnemonic condition was compared to a mnemonic verbal keyword, definitions with pictures, and definitions with sentence contexts. The mnemonic verbal keyword condition was similar to the keyword mnemonic condition except that typed keywords and an imposed typed sentence describing an interaction of the keyword with the vocabulary word was displayed instead of pictures. Subject performance in both of the keyword conditions was compared to subject performance in picture and verbal control conditions.

Subjects in the picture condition were provided with cards that had the word, the word's meaning, and a picture of the word's meaning printed on it. Subjects in the verbal condition were provided with cards listing the word, the word's definition, and sentence contexts for the word printed on them, and they were instructed to use these cards to study the words and definitions on their own. A planned multiple comparison procedure was used to analyze subject performance. To evaluate the significance of each of the planned comparisons, a multiple comparison procedure utilizing t-statistics was used.

Subject Characteristics

All students who were included in these studies had been classified as SLD or EH according to federal, state, and local criteria. The number of subjects in the reviewed studies ranged from 25 (Mastropieri, Scruggs, & Fulk, in press) to 240 (Berry, 1987). Fourth and fifth grade subjects participated in Berry's studies, and sixth, seventh, eighth, and ninth grade subjects participated in the remaining studies. In some studies, a comparison group of nonhandicapped subjects participated.

Measurement Methods

All of the studies reviewed used posttest data to determine the effectiveness of the conditions compared. Most frequently, the mean percentage correct of vocabulary

definitions was reported. Significance of these percentages was determined using an independent t-test when two interventions were investigated, or when more than two interventions were investigated and the researchers wanted to compare pairs of interventions to each other. Analysis of variance procedures were used to determine some main effects, and then tests such as Scheffe's and non-parametric analyses were used to determine where significant differences could be found.

Most studies determined subjects' knowledge of vocabulary definitions by verbal testing methods. For example, experimenters in the McLoone et al. (1986) study recorded subjects' verbal responses verbatim. Two independent judges scored these responses to establish interrater reliability. The only researchers that specified a different manner of determining subjects' knowledge of vocabulary definitions were Condus et al. (1986). These experimenters assessed subjects' knowledge of vocabulary defintions using a multiple-choice test format.

Condus et al. (1986) assigned students to conditions based on their receptive language ability according to the Peabody Picture Vocabulary Test-Revised. These researchers wanted to ascertain whether high-language or low-language ability impacted on the effectiveness of the mnemonic method versus other instructional methods.

Experimental Procedures

The length of the time for these studies ranged from 1 day (McLoone et al., 1986) to 5 weeks (Condus, Marshall, & Miller, 1986). The total instructional time for a day's session ranged from 20 minutes (Berry, 1987; Condus et al., 1986) to 25 minutes (McLoone, Scruggs, Mastropieri, & Zucker, 1986). The total instructional time for daily sessions was not stated in some studies (e.g., Mastropieri et al., 1985a), but investigators did state that the amount of time spent in treatment conditions was equivalent.

Materials. The materials used in all keyword mnemonic conditions were cards (e.g., 5" X 5", 8 1/2" X 11") that contained the vocabulary term, its keyword, the written definition of the term, and an interactive illustration of the keyword and the term's definition. The materials used in comparison conditions were similar cards that contained the vocabulary term, the written definition of the term, and an illustration of the term's definition. Researchers who used control conditions provided the students with a listing of the vocabulary terms and definitions, and materials (such as paper, pencils, flashcards) that the students could use to study the information (e.g., Berry, 1987).

Condus et al. (1986) compared the keyword mnemonic to picture context, sentence-experience context, and a control condition. The keyword mnemonic and control condition

materials were similar to the materials described for other studies. In the picture context condition students were instructed using illustrations that did not contain keywords. The keyword was replaced by a noun that had no acoustical similarity to the vocabulary item. The term, definition, and two-sentence conversation were also included in the illustration. For the sentence-experience materials, a three-sentence passage was printed and displayed on paper. The vocabulary term was incorporated into one of the sentences so that its context might help define the word. A question was printed under the sentences and the students were required to answer the question.

McLoone et al. (1986) used a directed rehearsal condition. The materials for this condition were cards that were similar to comparison conditions that had the vocabulary term and its definition printed on them. It was not reported whether an illustration of the term was also on the card. During the mnemonic keyword and directed rehearsal transfer conditions of this study, the materials were cards with vocabulary terms and definitions printed on them.

Instructional medium. Experimenters who were not the subjects' classroom teachers conducted most of these studies. Subjects were seen on an individual basis for the

instructional portion and assessment phases. Three studies differed from this medium.

Veit, Scruggs, and Mastropieri (1986) used an experimenter who was not the subjects' classroom teacher and the subjects were instructed in small groups of two to four students. Condus et al. (1986) trained seven teachers who were the teachers for the SLD subjects to conduct the investigation's instructional procedures. The instruction occurred in the teachers' resource classrooms and the students were seen in small groups.

Mastropieri, Emerick, and Scruggs (in press) trained classroom teachers of EH students to deliver instruction on science chapter content. The testing for these investigations was conducted by experimenters. The testing in all other studies was also conducted by experimenters.

Experimental constants. The instructions for all conditions except the control or free study conditions were read by the experimenter or teacher from a prepared script. Introductions to the lessons, regardless of the treatment that followed the introduction, were the same. The amount of instructional time with the experimenter or teacher was also the same. Several studies (e.g., Mastropieri et al., 1986; Veit et al., 1986) reported that corrective feedback, immediate feedback, positive reinforcement, and other effective teaching practices were used with students in all

treatment conditions. Assessment procedures for all conditions within a study were also the same.

Results

Experimenters who compared keyword mnemonics to one other condition (e.g., direct instruction or free study) indicated that the keyword mnemonic was more effective than the alternative method for learning the vocabulary definitions. Table 2-2 summarizes the numeric results of each of the experiments.

The overall percentage of correct definitions for subjects in the keyword mnemonic conditions was 73.2%. This percent is approximately 35% better than the overall percent correct for subjects in comparison conditions. The average effect size for all of the reviewed research was 1.71. An effect size is analogous to a standard score in that the calculation of an effect size makes the scale of measurement the same for all studies included in the calculation. An effect size of 1.71 is indicative of a powerful treatment effect for keyword mnemonics. In other words, the average student who received instruction using the keyword method would be expected to score higher than approximately 96% of students who did not receive instruction using the keyword method.

Subjects in the keyword mnemonic condition of Experiment 1 of the study conducted by Mastropieri et al.

Table 2-2. Numeric Results of Studies.

Investigators	Percent Correct Mnemonic versus Control	Effect Size
Mastropieri, Scruggs, Levin, Gaffney & McLoone (1985) - Experiment 1	79.5 versus 31.2	2.52
Mastropieri, Scruggs, Levin, Gaffney & McLoone (1985) - Experiment 2	69.3 versus 46.7	1.08
Veit, Scruggs & Mastropieri (1986)	53.7 versus 29.7	1.05
Condus, Marshall & Miller (1986)	56.0 versus 29.0	1.69
Berry (1986) - Experiment 1	82.9 versus 50.4	1.20
Berry (1986) - Experiment 2	77.0 versus 44.0	1.70
McLoone, Scruggs, Mastropieri & Zucker (1986) - Experiments 1 & 2	79.0 versus 35.0	1.95
Mastropieri, Scruggs & Fulk (in press)	66.7 versus 22.1	3.25
Mastropieri, Emerick & Scruggs (in press)	94.5 versus 58.8	.91
Summary	73.2 versus 38.5	1.71

Source: Mastropieri, M. A. & Scruggs, T. E. (in press). Constructing more meaningful relationships: Mnemonic instruction for special populations. Educational Psychology Review.

(1985c) scored statistically higher than the mean number of correct definitions in the direct instruction condition ($p < .001$). In Experiment 2, the results were also statistically higher for the subjects who had been provided a keyword and were required to generate their own interactive illustration when compared to the direct instruction group ($p < .01$).

Veit et al. (1986) extended the content of the SLD subjects' instruction to include 3 daily lessons on dinosaurs--vocabulary, attributes of dinosaurs, and reasons for dinosaur extinction. A test was given after each day's lesson, and on the 4th day students were given tests on the content of all three lessons. The mnemonic group scored statistically higher ($p < .008$) than the direct instruction group on all immediate and delayed recall tests, except the vocabulary test. On the vocabulary test the mnemonic group's scores were better than the direct instruction group's scores.

Condus et al. (1986) investigated the effectiveness of the keyword mnemonic method and three alternative methods on vocabulary acquisition and maintenance definition recall for SLD students. The subjects in this study were identified as having low- or high-receptive vocabularies according to the Peabody Picture Vocabulary Test-Revised. The measure of receptive vocabulary was used to ascertain whether the

keyword mnemonic method would be as effective with students having low- versus high-receptive vocabulary skills. This experiment occurred over a period of 5 weeks with 10 vocabulary words taught each week. Four measures were taken: immediately after instruction, at the end of the week, 2 weeks later (maintenance), and 8 weeks after the maintenance check.

The results were that all treatment groups performed significantly higher than students in the control condition. Students in the keyword condition performed better than students in the treatment conditions on the four levels of time. Students with high-receptive vocabulary performed better than subjects with low-receptive vocabulary across all conditions. However, results from the 8-week follow-up test yielded data that indicated that the students with low-receptive vocabularies in the keyword condition performed better than students with high- and low-receptive vocabularies assigned to alternative conditions. On the basis of the findings, the investigators concluded that learning disabled students receiving keyword instruction can effectively use a complex method such as the mnemonic method regardless of their receptive language ability. Moreover, the keyword method seemed to help the SLD students learn and retain more word meanings than students with the same

receptive language skills receiving alternative methods of instruction.

In addition to investigating the benefits of providing SLD subjects with a mnemonic method for learning vocabulary definitions, Berry (1987) was also interested in how the results of her experiments lent support for theoretical views of learning disabilities (e.g., developmental lag, verbal deficit, or structural versus process deficit). The subjects in her first experiment were fourth and fifth grade SLD students, fourth and fifth grade chronological-age match students, and students who matched the SLD subjects on reading level. The subjects were divided among the four treatment conditions. Learning disabled and reading-age match subjects in the keyword picture condition recalled more than the subjects in the other three conditions (mnemonic verbal keyword, definitions with pictures, and definitions with sentence contexts). Berry concluded that the overall results of this experiment provided support for SLD subjects overcoming the performance deficit associated with the developmental lag theory of learning disabilities when they are instructed using the keyword mnemonic method.

In Berry's second experiment (1987), the subjects were SLD and nonhandicapped fourth graders who were instructed with keyword mnemonic and nonmnemonic conditions. The mean percentage recalled after keyword mnemonic instruction for

SLD and nonhandicapped students was 76.7% versus 83.7%. Berry inferred that problems students have when learning vocabulary definitions may be modifiable through keyword mnemonic instruction.

McLoone et al. (1986) compared mnemonics to direct instruction. However, these investigators also included transfer conditions. The same subjects who had participated in the mnemonics and direct instruction conditions were trained in the independent use of the treatment they had just received. The vocabulary items used in this study were low-usage English and Italian vocabulary. Students in the mnemonic condition recalled significantly more vocabulary items than students in the direct instruction condition. Similar results were obtained in the transfer conditions. Students in the mnemonic condition recalled significantly more items than the students in the direct instruction.

Mastropieri et al. (in press) investigated the performance of SLD students when learning concrete and abstract vocabulary in a keyword mnemonic and rehearsal condition. Subjects in the keyword mnemonic condition recalled significantly more than subjects in the rehearsal condition on two types of tests. The first test was an assessment of the subjects' ability to state the definition of the vocabulary term. The second test was a comprehension test, and the subjects were required to match the vocabulary

word to a novel use of the word. There were no significant differences in the recall of abstract versus concrete words.

Mastropieri, Emerick, and Scruggs (in press) investigated the recall of EH students who received instruction on science terms using both the keyword mnemonic method and traditional instruction. Two chapters of the students' science text were adapted for the keyword mnemonic method, and students received instruction in a counterbalanced design so that each student served as his or her own control. When instructed using the keyword mnemonic materials, the EH students learned and retained more information of science concepts than when they were instructed using traditional methods. In addition, the students reported enjoying and learning more when taught with the keyword mnemonic method.

Summary

Learning disabled and emotionally handicapped students who have been instructed with the keyword mnemonic method to help them learn vocabulary definitions acquire and retain more information than students who have been instructed with other methods. In some instances, the mildly handicapped students' recall of definitions has approximated the performance of chronologically-aged peers' recall of definitions. The importance of these research findings is

amplified when combined with the implications regarding learning in the classroom; a strategy that enhances a student's memory and recall of information may result in improved learning in school.

Moreover, the keyword mnemonic method appears to be more effective for long-term retention of information for students who have been identified as having low-receptive vocabularies. In addition, students who have received training regarding the use of the keyword mnemonic method after having been involved in an experiment with the use of this method have been successful in performing better than students who have been trained in the use of a direct instruction method. The indication is that students are capable of learning a keyword mnemonic strategy. If students can be taught a strategy to make up their own keywords and imagine interactive illustrations, then the students will have learned a skill that helps them to independently learn definitions of unfamiliar vocabulary.

The use of the imposed keyword method has been successful for students' performance when they are required to define previously unfamiliar terms. However, the imposed method does not promote independent learning for the students because the experimenter is providing the keywords and interactive illustrations. An induced keyword method is necessary in order for mildly handicapped students to be

able to independently learn definitions. Enhanced memories, expanded vocabularies, and improved achievement in school are just a few of the benefits that students may experience if they can use the keyword mnemonic method independently. The purpose of this study was to extend the efforts of prior researchers and to determine whether mildly handicapped students could learn to use the keyword mnemonic method independently.

Chapter III specifies the methodology used in this investigation. Results are presented in Chapter IV and discussed in Chapter V.

CHAPTER III
METHOD

The research methods in this investigation were designed to allow the investigator to compare the performance of subjects' recall of science words' definitions among three treatment conditions. The conditions were systematic teaching, systematic teaching with a teacher-provided keyword mnemonic, and systematic teaching with a subject-provided keyword mnemonic. Recall effects on initial acquisition, short-term retention, and long-term retention of definitions in each condition were measured. In addition, daily measures of the rate of acquisition of recall of definitions are reported in order to determine learning trends among the three conditions. The research methodology including descriptions of the subjects, null hypotheses, instrumentation, materials, procedures, and experimental designs and analyses is presented in this chapter.

Subjects

The subjects for this study were specific learning disabled (SLD) and emotionally handicapped (EH) students in the sixth, seventh, and eighth grades. Each student was eligible for SLD or EH placement according to the criteria for placement in special education required by the state of Florida. Thirty-four males and three females participated in this investigation. Further descriptions of the subjects are found in Table 3-1, according to the suggested descriptors by Smith et al. (1984). All subjects received treatment instruction from their special education teacher in a varying exceptionality resource classroom located in Alachua County, Florida. Each teacher was randomly assigned to one of the three treatment conditions. The teachers taught two of their classes the corresponding treatment conditions, but all students were not subjects in this study unless they were eligible according to predetermined qualifications. The subjects who participated could write definitions for simple words, scored less than 40% on screening measures, and were not absent from school for the majority of instruction (i.e., two out of three days present) and on the assessment day for each of the weeks of this study.

Table 3-1. Description of Subjects.

Systematic Teaching		Teacher-Provided Keyword		Subject-Provided Keyword	
Numbers:		Numbers:		Numbers:	
male	9	male	11	male	14
female	1	female	2	female	0
total	10	total	13	total	14
Age:		Age:		Age:	
mean	13.7	mean	12.7	mean	13.4
range	12-14	range	11-14	range	12-15
Race:		Race:		Race:	
Anglo	5	Anglo	8	Anglo	8
Black	5	Black	4	Black	6
SES:		SES:		SES:	
high	0	high	0	high	0
middle	4	middle	8	middle	8
low	6	low	4	low	6
IQ:		IQ:		IQ:	
mean	92	mean	106	mean	93
range	80-108	range	94-120	range	71-111
test(s) used	WISC-R K-ABC	test(s) used	WISC-R K-ABC	test(s) used	WISC-R K-ABC
Exceptionality:		Exceptionality:		Exceptionality:	
SLD	10	SLD	11	SLD	9
EH	0	EH	1	EH	5
Reading achievement:		Reading achievement:		Reading achievement:	
mean	79	mean	88	mean	81
range	56-97	range	56-112	range	62-103
test(s) used	W-J K-ABC	test(s) used	W-J K-ABC	test(s) used	W-J K-ABC
Spelling achievement:		Spelling achievement:		Spelling achievement:	
mean	72	mean	82	mean	72
range	53-94	range	64-103	range	64-90
test(s) used	WRAT	test(s) used	WRAT	test(s) used	WRAT
Grade in school:		Grade in school:		Grade in school:	
Sixth	3	Sixth	3	Sixth	6
Seventh	0	Seventh	9	Seventh	3
Eighth	7	Eighth	1	Eighth	5

Hypotheses

The dependent variables that were examined in this study were the recall of definitions for subjects who were taught in one of three ways. The three interventions were systematic teaching, systematic teaching with a teacher-provided keyword mnemonic, and systematic teaching with a subject-provided keyword mnemonic. The subjects' recall of definitions was measured for acquisition during the instructional intervention, short-term retention 1 week after instruction had ended, and long-term retention 3 weeks after instruction had ended. Recall was measured by using both a written (production from memory) and matching (recognition) format. In addition, the subjects' rate of acquisition of definitions during each instructional week was measured and is reported in Chapter IV. The following null hypotheses addressed the effects of the three conditions regarding subjects' recall related to acquisition and retention.

H1: There will be no statistically significant difference among the experimental groups on acquisition of vocabulary definitions recalled on the day after instruction has occurred.

H2: There will be no statistically significant difference among the experimental groups on short-term

retention of vocabulary definitions recalled 1 week following instruction.

H3: There will be no statistically significant difference among the experimental groups on long-term retention of vocabulary definitions recalled 3 weeks following instruction.

The basis for rejection of a null hypothesis was the .05 level of significance.

Instrumentation

Five research instruments were used. The first two instruments, the Written Vocabulary Definition Screening Device and the Matching Vocabulary Definition Screening Device, were used to determine whether the students could write or match definitions of less than 40% of the vocabulary. The next instrument, the Daily Measure of Vocabulary Definition Device, was used daily in order to determine rate of acquisition for subjects when writing definitions, and also to determine learning trends. The fourth and fifth instruments, the Written Vocabulary Definition Device and the Matching Vocabulary Definition Device, included all targeted vocabulary words and was used on a weekly basis during this investigation to determine

subjects' production (writing) and recognition (matching) recall of vocabulary definitions.

Ninety words were used for the screening tests. Following the administration of these tests, 60 words were randomly selected for use in this study. Forty-eight of the 60 words were randomly selected as the treatment words. The remaining 12 of the 60 words were used as example words for the 1st day of instruction during each of the 4 instructional implementation weeks, i.e., three words per week were example words and served as demonstration words for that week's session. The 15 words were clustered according to their relation to each other. The four categories of words were animal and plant life terms, earth science terms, body terms, and weather and astronomy terms. The purpose of this categorization was to approximate more closely the teaching of words in a science classroom as a functional unit of instruction.

Varied forms of the Written Vocabulary Definition Device and the Matching Vocabulary Definition Device were used. The word categories were listed in different orders each time the tests were administered to the subjects. Both of these devices were criterion measurement instruments that were used to determine subjects' production (writing) and recognition (matching) recall.

Written and Matching Vocabulary Definition Screening Devices

The Written and Matching Vocabulary Definition Screening Devices consisted of 90 vocabulary words listed in a column on worksheets and then the words were listed with a selection of definitions for subjects to match (See listing of words in Appendix A). The subjects were required to write and then match the definitions of as many words as they could. Subjects with scores of less than 40% on the written and matching screening were eligible for participation in this investigation.

Daily Measure of Vocabulary Definition Device

The Daily Measure of Vocabulary Definition Device (See Appendix B) was used immediately following each of 3 days of instruction. This device was used to report the rate of acquisition of recall of vocabulary definitions, as well as learning trends, for subjects in all three conditions. Each week's device had the 12 targeted words for instruction for that week listed on it. The words were listed in a random order each day. The subjects were required to write the definitions of the words that they remembered. A group mean percentage score for all subjects in each condition was used to report the results of this measure.

Written and Matching Vocabulary Definition Devices

The Vocabulary Definition Devices (See Appendices B and C for examples) consisted of 48 of the 60 words randomly selected for use in this study. Forty-eight terms were randomly selected as the targeted words for instruction. Different forms of the Written Vocabulary Definition Device and the Matching Vocabulary Definition Device were used throughout the study with the word categories in varied orders for each week. Twelve words were taught each week over a period of 4 weeks. The remaining 12 words from the total of 60 were used as example words--three example words for each Day 1 of the 4 instructional implementation weeks.

Materials

The materials that were used with subjects in the systematic teaching condition were 8 1/2" X 11" cards with the word, its definition, and an illustration of the definition displayed on it. Subjects in the systematic teaching with a teacher-provided keyword condition were provided with two cards. The first card was a 5" X 8" card with the vocabulary word on one side and the keyword on the other side. The second card was an 8 1/2" X 11" card that had the keyword, the vocabulary word, its definition, and an interactive illustration of the keyword that does something

with the definition of the vocabulary word printed on it. The cards for the three example words used in the teacher-provided mnemonic condition were also used with the subject-provided mnemonic condition as example words on Day 1 of the last 3 instructional weeks.

Subjects in the systematic teaching with a subject-provided keyword mnemonic condition received the same instruction and used identical materials as the subjects in the systematic teaching with a teacher-provided keyword mnemonic condition during the 1st week of this investigation. During the last 3 weeks of instruction, these subjects were taught a strategy to help them make up their own keywords and imagine interactive illustrations of their keywords doing something with the definition of the term. A poster with the strategy steps stated was displayed in the classroom for the duration of the instructional implementation period. Cards (8 1/2" X 11") listing the vocabulary term and definition were used. Index cards (3" X 5") were available for the subjects to use for writing the vocabulary term and keyword that the subject had made up. Examples of the 8 1/2" X 11" cards that were used in each condition are located in Appendix D.

Procedure

The procedure for this investigation was divided into four phases. Phase one was a screening procedure to determine subject eligibility and to elicit motivation to participate in this study. Phase two was a training period for the teachers involved in the investigation. Phase three was the instructional implementation that occurred over a period of 4 weeks. On Days 1, 2, and 3 of each instructional implementation week, the subjects were instructed on 12 of the vocabulary definitions. Immediately following instruction on these three days, the subjects were given a listing of the 12 vocabulary terms targeted for instruction during that week (the Daily Measure of Vocabulary Definition Device). The subjects were allowed 5 minutes to write the definitions of the words that they remembered. The purpose of the daily measures was to determine the rate of acquisition and the learning trends for subjects in each condition throughout the 3 instructional days. Phase four included measurement of subjects' recall of vocabulary definition for acquisition, short-term retention, and long-term retention. The subjects were assessed on Day 4 of each instructional week using the Written Vocabulary Definition Device and the Matching Vocabulary Definition Device. The subjects' recall of definitions during the instructional

implementation was considered acquisition. The subjects' recall of definitions 1 week after instruction was considered short-term retention. The subjects' recall of definitions 3 weeks after instruction was considered long-term retention. The remainder of this section provides details of each procedural phase.

Screening (Phase One)

A screening procedure was used to determine subject eligibility for participation in this study and to target unfamiliar science vocabulary words from a 10th grade general science text used in the Alachua County schools. This screening was conducted to make certain that the words were unfamiliar vocabulary words that the students could not define correctly. Initially, subjects were asked to write definitions of six words. These words were purse, table, eat, rug, family, and dog. If a subject could write definitions of simple words then it was assumed that, given the knowledge of a word's definition, the subject could write definitions for other words.

The screening consisted of 90 science vocabulary words. The students were directed to write the definitions of these words (from memory) and then to match the words to their definitions. Critical components of the definitions, as indicated by the science texts' glossary, were used to

determine correct and incorrect definitions. An overall score of less than 40% of words defined correctly indicated that the subject was eligible for participation in this investigation. Results of the screening for the 48 words targeted for instruction in this study are reported in Chapter IV.

An additional condition for participation in this investigation was the willingness of each subject to learn new vocabulary terms and definitions. Subjects who participated in this study indicated this motivation and desire by stating in writing that they wanted to learn new vocabulary terms and definitions. The subjects' teachers also discussed with them reasons why learning definitions of new words could help them with their schoolwork and how the subjects could benefit from learning new words. The grades that the subjects received on the weekly tests were considered as a portion of each subject's classroom grade. The form that the subjects signed, which indicated their intent to participate in this investigation, is in Appendix E.

Teacher Training Procedures (Phase Two)

The teachers volunteered to participate in this investigation. They attended several training sessions as a group or individually prior to beginning intervention with

their students. The training was conducted at the Alachua County School Board building or at the teacher's school. The teachers were given monetary stipends from the county for attendance at the training sessions. The training procedures are outlined in Appendix F. Mastery in administering the instructional procedures for the corresponding condition for each teacher was demonstrated before teachers began treatments with subjects.

Independent observers viewed teacher demonstrations and recorded appropriate teacher behaviors using a Time Sampling Recording Form (See Appendix G). Teacher behaviors that were measured were following the script, following the sequencing of the script, fluent pacing of the instruction, and using the materials for the corresponding treatment correctly. Interobserver reliability is reported in Chapter IV.

A compilation of effective teaching and direct instruction components of other researchers (e.g., Engelmann, 1980; Gersten, Woodward, & Darch, 1986; Walberg, 1984) was used to determine teaching practices in all conditions--systematic teaching. For example, all teacher scripts began with an advance organizer and then proceeded to demonstration, modeling, and guided practice phases, as well as an evaluation phase.

In addition, teacher behaviors such as corrective feedback, positive reinforcement, prompts, and elicitation of active student involvement were used in all conditions. The teacher behaviors were consolidated into an acronym that reminded the teachers how to elicit and react to subject responses--PEP. The first P means to Prompt to elicit responses from the subjects. A teacher could prompt by repeating the definition or word for the subject, pointing to the words or pictures on the materials used, using proximity control, or establishing eye contact. The E means to Evaluate subject's responses by stating immediate and corrective feedback. The last P means to Positively reinforce subject's responses, and this could be general or specific praise for the subjects regarding their responses and performance.

All treatment conditions used aspects of systematic teaching during all instructional implementation days. Borkowski and Buchel (1983) recommended the use of the best alternative treatment condition when comparing other interventions. For this reason, and to replicate what has been called "direct instruction" and "directed rehearsal" in the research reviewed in Chapter II, the name given to the control, or best alternative treatment condition, was systematic teaching.

Instructional Implementation (Phase Three)

For each condition, 48 of the 60 words were targeted for use during each of the 4 weeks of instructional implementation--15 for each week. Three of the 15 vocabulary terms were used for demonstration purposes on Day 1 of each of the 4 weeks of implementation. Twelve words were targeted for definition recall for each of the 4 weeks of the instructional implementation. The words were clustered into four categories so that teachers were instructing subjects on words that were related to each other.

On Day 1, 15 minutes were used for instruction. On Days 2 and 3, 12 minutes were used for instruction. Immediately following each instructional day, the subjects were given a listing of the 12 vocabulary terms targeted for instruction during that week (the Daily Measure of Vocabulary Definition Device). The subjects were allowed 5 minutes to write the definitions of the words that they remembered. The purpose of the daily measures was to describe the rate of acquisition of definitions for subjects in each condition, as well as to describe their learning trends throughout the instructional days of each week.

On Day 4, subjects were assessed using the Written Vocabulary Definition Device and the Matching Vocabulary Definition Device. The subjects were instructed to find the

words that they knew and write the definitions of those words. The subjects first completed the production (written) assessment and then they completed the recognition (matching) assessment. The purpose of using all 48 words on the Written and Matching Vocabulary Definition Devices for each Day 4 was to use a standard measure on all words at the end of each instructional week. The use of a standard measure allowed the investigator to ascertain that the subjects were learning definitions of words after instruction had occurred and that the subjects were not learning definitions of words without instruction. In addition, the four categories of 12 words from the 48 words were randomly assigned for each week of instruction. All subjects received instruction on the same category of words each week.

It was anticipated that the subjects could neither write nor match definitions of words not yet included in the instruction. Indeed, the subjects had demonstrated an inability to define by writing or matching definitions of less than 40% of the words during the screening procedure prior to implementation of this study. The teachers emphasized that the subjects were not expected to write definitions for all of the words, especially during the first 3 weeks of instructional implementation. In other words, the subjects were encouraged to find the words that they could

define, and it was acknowledged that the assessments contained words that the subjects had not received instruction on and, consequently, were not expected to know.

Systematic Teaching Condition. The teacher demonstrated the three example words during the first 3 minutes of each Day 1 of the 4 instructional implementation weeks. A cassette recorder with audible tones at intervals signaled to the teacher when it was time to begin instruction on the target words on Day 1, and how much time the teacher had left for instruction for the remainder of Day 1 and the entire lesson on Days 2 and 3. Instruction techniques including a rapid pace, active student involvement by using questioning, choral and individual responses, immediate and corrective feedback, and positive reinforcement (i.e., PEP) were maintained throughout instruction of the 12 targeted terms on Days 1, 2 and 3. The teacher followed a scripted lesson format (See Appendix H).

Following each instructional day, the subjects were given a listing of the 12 vocabulary terms targeted for instruction during that week (the Daily Measure of Vocabulary Definition Device). The subjects were allowed 5 minutes to write the definitions of the words that they remembered. At the end of 5 minutes, subjects' papers were collected and the teacher provided immediate and corrective feedback for the

daily quizzes by stating the terms and definitions using the cards for the systematic teaching condition. Approximately 2 minutes were used to deliver this feedback to the subjects.

On Day 4 the subjects were given a form of the Written Vocabulary Definition Device and then the Matching Vocabulary Definition Device. The subjects were instructed to find the words they knew and write the definitions of those words. After subjects had completed the production (written) assessment, then they completed the recognition (matching) assessment. There was no set time limit for these assessments. Subjects received feedback on these assessments on the Monday following the completion of these tests. The subjects recorded acquisition (the 12 words taught during that week), retention (the 12 words taught during last week), and overall scores (the 48 words taught during the 4 weeks of intervention) for each week for their written and matching tests on a graph.

Systematic Teaching with a Teacher-Provided Keyword Mnemonic Condition. The teacher in the systematic teaching with a teacher-provided keyword mnemonic condition demonstrated the keyword method using three of the 15 words that were designated as example words. This procedure was followed on each Day 1 of the 4 instructional implementation weeks. Following the demonstration of the three example

words, instruction occurred on Days 1, 2, and 3 on the 12 words targeted for that week.

Two cards were used for each vocabulary term. The first card (5" X 8") had the vocabulary term printed on one side and the keyword printed on the other side. The subjects first learned the keyword for each vocabulary term. Then the second card was used. Keyword pictures were drawn on 8 1/2" X 11" cards. The vocabulary term, its definition, the keyword, and the interactive illustration of the keyword that does something with the definition of the vocabulary term were printed on it. The teacher followed a scripted lesson format (See Appendix I). A cassette recorder with audible tones at intervals signaled to the teacher when it was time to begin instruction on the target words on Day 1, and how much time the teacher had left for instruction for the remainder of Day 1 and the entire lesson on Days 2 and 3.

The teacher first stated the pronunciation of the vocabulary term and then told the subjects the keyword that helped the subjects remember the term's definition. After the subjects associated the term with the keyword, then the subjects were told that the way to remember the term and definition was to remember the keyword and the interactive illustration of the vocabulary term. Subjects were questioned regarding the keyword, the interactive

illustration, and the definition of the vocabulary term. Instruction including a rapid pace, active student involvement via questioning, choral and individual responses, immediate and corrective feedback, and positive reinforcement (i.e., PEP) were given throughout the 3 days of instruction for each week.

Following each instructional day, the subjects were given a listing of the 12 vocabulary terms targeted for instruction during that week (the Daily Measure of Vocabulary Definition Device). The subjects were allowed 5 minutes to write the definitions of the words that they remembered. At the end of 5 minutes, subjects' papers were collected and the teacher provided immediate and corrective feedback for the daily quizzes by stating the terms and definitions using the cards for the systematic teaching with the teacher-provided keyword condition. Approximately 2 minutes were used to deliver this feedback to the subjects, and there was no interaction between the teacher and the subjects during this time other than the teacher reading the definitions of the terms.

On Day 4 the subjects were given a form of the Written Vocabulary Definition Device and the Matching Vocabulary Definition Device. The subjects were instructed to find the words they knew and write the definitions of those words.

After subjects had completed the production (written) assessment, then they completed the recognition (matching) assessment. There was no set time limit for these assessments. Subjects received feedback on these assessments on the Monday following the completion of these tests. The subjects recorded acquisition, retention, and overall scores for each week for their written and matching tests.

Systematic Teaching with a Subject-Provided Keyword Mnemonic Condition. The procedure for this condition was identical to the procedure for the teacher-provided keyword mnemonic condition for the 1st week of instruction. The rationale for this was that the subjects needed sufficient demonstration of the keyword method so that they could understand it well enough to use it independently. During the 2nd, 3rd, and 4th weeks of intervention the subjects were required to provide their own keyword and imagine the definition of the term that interacts with their keyword.

The Day 1 procedure began the same as the procedure for the teacher-provided keyword. The teacher demonstrated the keyword and interactive illustration method using three words that were designated as example words for that category of words.

For the example words, the teacher first stated the pronunciation of the vocabulary term and the keyword that

could help the subjects remember the term's definition. After the subjects associated the term with the keyword, then the subjects were told that the way to remember the term and definition was to remember the keyword and the interactive illustration of the vocabulary term. Subjects were questioned regarding the keyword, interactive illustration, and definition of the vocabulary term. Instruction including a rapid pace, active student involvement by questioning, choral and individual responses, immediate and corrective feedback, and positive reinforcement (i.e., PEP) were given throughout the 3 days of instruction for each week. The PEP was provided to the subjects both during the demonstration of the example terms and individually during the instruction.

At this point the subject-provided keyword mnemonic condition differed from the teacher-provided keyword mnemonic condition. The subjects were told that they would now receive instruction on how to make up their own keyword and interactive illustration by using imagery to remember definitions of vocabulary terms. The following describes the strategy that the subjects were taught. The teacher followed a scripted lesson format (See Appendix J).

The subjects were told that they had to think of a keyword that was similar to the vocabulary term by using an acoustic link, or a similar sound, between the vocabulary

term and the keyword. The keyword must be a familiar word for the subject, and the keyword could be a rhyming word or a word similar to, or a part of, the vocabulary term. The subjects were reminded of the three demonstration vocabulary terms for that week of instruction, as well as the keywords and interactive illustrations that they had learned during the 1st week of instruction. The subjects were told to refer to those examples when necessary. The subjects were taught a strategy to help them use the induced keyword method.

An acronym was used to help the subjects remember the steps of the strategy. The acronym was IT FITS. A poster with the IT FITS steps printed on it was displayed throughout the instructional sessions of the last 3 implementation weeks. The steps for the strategy are as follows:

1. Identify the term.
2. Tell the definition of the term.
3. Find a keyword.
4. Imagine the definition doing something with the keyword.
5. Think about the definition doing something with the keyword.
6. Study what you imagined until you know the definition.

The rationale for this sequence of steps is that the subjects must first be able to say the term and state the definition so that the term's pronunciation and meaning become familiar to the subjects (the IT part of the strategy). The teacher identified the term and stated the term's definition to the subjects during this study. Then the subjects needed to find a keyword and imagine an interactive illustration of the keyword, the term, and the definition of the term (the FITS part of the strategy).

Atkinson (1975) claimed that the critical link to the keyword method is that the keyword makes the subject think about the interaction and term. Thus, the keyword must remind the subject of the information needed--the definition of the term (this is the FITS part of the strategy). The subjects spent the remaining 12 minutes of Day 1 (after 3 minutes were used to demonstrate the keyword and interactive illustration using keywords and interactive illustrations that the teacher had provided) using this strategy to learn the definitions of the vocabulary. The subjects used the entire 12 minutes on Days 2 and 3 using this strategy to help them learn the definitions of the vocabulary terms.

Following each instructional day, the subjects were given a listing of the 12 vocabulary terms targeted for instruction during that week (the Daily Measure of Vocabulary

Definition Device). The subjects were allowed 5 minutes to write the definitions of the words that they remembered. At the end of 5 minutes, subjects' papers were collected and the teacher provided immediate and corrective feedback for the daily quizzes by stating the terms and definitions using the cards for the systematic teaching with the subject-provided keyword condition. Approximately 2 minutes were used to deliver this feedback to the subjects, and there was no interaction between the teacher and the subjects during this time other than the teacher reading the terms and definitions.

The subjects worked independently to find a keyword (i.e., a familiar word for them) that sounded similar to the vocabulary term during the 3 days of instruction for each week. The teacher stated each vocabulary term and its definition, displayed the cards with the term and definition printed on them, and then circulated and assisted while subjects thought of a keyword to go with each term. The subjects were provided with 3" X 5" cards so that they could write the term and their keyword on reverse sides of the cards. After the subjects had thought of a keyword for a term, the subjects were instructed to imagine a picture of the keyword that interacts (i.e., that does something) with the definition. A timer was used to indicate the end of each

day's predesignated length of instruction (12 minutes). Throughout the instructional time on Days 1, 2, and 3, the teacher emphasized that the subjects needed to follow the steps of IT FITS. Positive reinforcement was given to encourage the subjects and to maintain motivation. Verbal prompts to encourage the subjects to find a rhyming word or a word within the unfamiliar word were given when necessary.

On Day 4 the subjects were given a form of the Written Vocabulary Definition Device and then the Matching Vocabulary Definition Device. The subjects were instructed to find the words that they knew and write the definitions of those words. After subjects had completed the production (written) assessment, then they completed the recognition (matching) assessment. There was no set time limit for these assessments. Subjects received feedback on these assessments on the Monday following the completion of these tests. The subjects recorded acquisition, retention, and overall scores for each week for their written and matching tests on graphs.

Control variables. There were five controls for the instructional components of this study.

1. All subjects spent the same amount of time learning the terms and definitions.

2. All subjects were taught by their classroom teacher.

3. The same words were used for all conditions for each of the 4-week instructional implementation phase. The subjects' lack of knowledge of the majority of the words was measured by screenings prior to the implementation of the study.

4. The subjects were allowed 5 minutes at the end of Days 1, 2, and 3 of instruction to write the definitions that they remembered of the 12 words targeted for instruction that week. This measure was used to determine rate of acquisition for subjects in all conditions.

5. Effective teaching techniques and teacher behaviors, described in this study as systematic teaching, were used in all conditions.

Measurement (Phase Four)

On Day 4 of each of the 4 weeks of instructional implementation, the Written Vocabulary Definition Device and the Matching Vocabulary Definition Device were given to the subjects in order to measure production (writing) and recognition (matching) performance regarding vocabulary definitions. The written assessment was always given to the subjects first, and then the subjects were given the matching assessment.

The Vocabulary Definition Devices were also used 1 week (Week 5) and 3 weeks (Week 7) after the completion of the 4

instructional implementation weeks. Subjects' short-term retention and long-term retention of the vocabulary definitions was measured during these times.

A graduate student who was trained regarding essential components of the definition that must be written in order to count a definition correct scored the written measurement devices. The subjects received 1 point for words defined correctly, .5 point for definitions that were partially correct, and no points for incorrect definitions. In addition, a secondary science teacher who has a masters degree in chemistry was available for consulting with the graduate student if she was unsure of the correctness of an answer.

The worksheets were in a mixed order when graded so that the graduate student was unaware of the treatment condition for each subject. A second graduate student who was similarly trained scored a random selection of the written measurements to determine reliability regarding correct, partially correct, or incorrect definitions. Both graduate students were unaware of this study's interventions for the duration of the study. The results of the reliability for scoring the written tests are reported in Chapter IV.

Experimental Design and Analysis

The dependent variables were the subjects' recall of definitions. Both a written (production) and a matching (recognition) measurement were used. The independent variables were the interventions: (A) systematic teaching, (B) systematic teaching with a teacher-provided keyword, and (C) systematic teaching with a subject-provided keyword. The data from the Written and Matching Vocabulary Definition Devices were analyzed in two ways to reject or accept each of the null hypothesis. An analysis of covariance (ANCOVA) was performed with subjects' Intelligence Quotient (IQ) as the covariate. Significant main effects or interactions were identified using Bonferroni comparisons. The significance level was .05.

Written and Matching Scores on 48 Words

The subjects' scores from the written and matching tests on 48 words from the 2nd, 3rd, and 4th weeks of instruction were analyzed to determine acquisition effects. Scores from the 1st week of this study were not analyzed because two conditions had the same treatment during that week. An analysis of covariance (ANCOVA) with repeated measures was used to determine statistical differences. Significant main effects or interactions were identified by using Bonferroni comparisons.

An ANCOVA was used to analyze the data from the written and matching measures of the 48 words from the 5th and 7th week of the study. These weeks were 1 and 3 weeks following the conclusion of the instruction. Analyses from the 5th week were used to determine short-term retention effects, and analyses from the 7th week were used to determine long-term retention effects.

Written and Matching Scores on 12 Words

The subjects' scores on the 12 words taught during the 4th, and last, week of the study were derived from the written and matching tests on 48 words. By the last week of the study, all subjects had received at least two weeks of instruction regarding their method of intervention. All subjects were attaining higher levels of fluency and proficiency. This was especially true for subjects in the subject-provided keyword condition, because they did not begin their strategy intervention until the 2nd week of the study. The scores for these 12 words were analyzed during the week they were taught to determine acquisition effects. An ANCOVA was used to determine whether there were significant main effects, and Bonferroni comparisons were used when significant main effects were found.

The identical procedure was used to analyze the subjects' scores on the same 12 words during the 5th and 7th

week tests. The subjects' scores were derived from the 48-word tests. Analyses from the 5th week were used to determine short-term retention effects, and analyses from the 7th week were used to determine long-term retention effects.

CHAPTER IV
RESULTS

This chapter presents the data gathered to answer the experimental questions. First, the interobserver agreement obtained from the teacher training procedures prior to and during the study's implementation is reported. Second, scorer reliability for the Written Vocabulary Definition Device is reported. Results of the Vocabulary Screening Devices for the written and matching measures are stated. Next, statistical analyses of the dependent variables based on the three hypotheses are reported. Finally, descriptive analyses of the data, related findings, and a summary are given.

Teacher Training Interobserver Agreement

A time sampling recording form was used to obtain interobserver agreement regarding each classroom teacher's ability to implement her corresponding condition. The time sampling recording form was used one time prior to the implementation of the study and one time during the

implementation of the study. The teachers were observed during the 2nd or 3rd week of the study for the second time sampling recording. Interval agreement was calculated according to procedures described by Tawney and Gast (1984). Agreements were divided by the total number of possible agreements and then multiplied by 100 to obtain a percentage.

There were four behaviors that the teachers were scored on at 30-second intervals. These behaviors were following the script, following the sequence of the script, fluent pacing during instruction, and using instructional materials correctly. The overall interobserver agreement prior to implementation of the study was 93%. The overall interobserver agreement during implementation of the study was 95%. Individual scores for each behavior on each teacher are presented in Table 4-1.

Scorer Reliability for Written Tests

Two graduate students graded the subjects' written tests. Both graduate students were unaware of the conditions of this study. One graduate student initially graded the written measures and the other graduate student graded a random selection to determine reliability. The subjects' written definitions were scored as correct (subject received 1 point), partially correct (subject received .5 point), or incorrect (subject received no points). The reliability for the two graduate students' grading of written definitions was 97%.

Table 4-1. Interobserver Agreement on Teacher Behaviors.

Teacher	Script	Sequence	Pacing	Materials	Total Percentage
Training Lessons:					
A					
Teacher 1	23/24	24/24	23/24	24/24	94/96 = 98%
B					
Teacher 2	24/24	22/24	19/24	24/24	89/96 = 93%
Teacher 3	20/24	19/24	23/24	24/24	86/96 = 90%
C					
Teacher 3	10/12	8/12	12/12	12/12	42/48 = 88%
Overall Interobserver Agreement during Training					311/336 = 93%
Study Implementation:					
A					
Teacher 1	30/30	28/30	28/30	30/30	116/120 = 97%
B					
Teacher 2	26/30	25/30	28/30	30/30	109/120 = 91%
C					
Teacher 3	28/30	29/30	29/30	30/30	116/120 = 97%
Overall Interobserver Agreement during Study					341/360 = 95%

The graduate student who determined reliability scored an average of nine subject assessments each week.

Vocabulary Screening Devices

The subjects were administered a form of the Written Vocabulary Screening Device. After the written screening was completed, then the Matching Vocabulary Screening Device was administered. The results of these screenings, presented in Table 4-2, are reported for the 48 words that were targeted for instruction during this investigation.

Subjects in the systematic teaching (Group A) condition could write approximately one of the definitions on the Written Vocabulary Screening Device. These subjects could match approximately two of the definitions on the Matching Vocabulary Screening Device.

Subjects in the systematic teaching with the teacher-provided keyword (Group B) condition could write approximately five of the definitions on the Written Vocabulary Screening Device. These subjects could match approximately eight of the definitions on the Matching Vocabulary Screening Device.

Subjects in the systematic teaching with the subject-provided keyword (Group C) condition could write approximately one of the definitions on the Written Vocabulary Screening Device. These subjects could match approximately three of the definitions on the Matching Vocabulary Screening Device. None

Table 4-2. Results of the Written and Matching Vocabulary Screening Devices.

Condition	Written	Matching
A		
Systematic Teaching		
Average	1.10	2.22
Standard Deviation (SD)	1.88	4.15
Range	0.00 - 9.00	0.00 - 12.00
B		
Systematic Teaching		
Teacher-Provided Keyword		
Average	5.00	8.00
Standard Deviation (SD)	3.29	5.66
Range	1.50 - 9.50	4.00 - 12.00
C		
Systematic Teaching		
Student-Provided Keyword		
Average	1.36	2.82
Standard Deviation (SD)	1.70	2.44
Range	0.00 - 5.50	0.00 - 7.00

of the subjects, neither individually nor as a group, surpassed the predetermined cutoff score of writing or matching 40% (19 out of 48) of the definitions.

An analysis of variance test was conducted to determine whether there was a significant difference among the three groups on the written and matching screening measures. Results of these analyses are reported in Tables 4-3 and 4-4. There was a significant main effect for the written screening. A Scheffe post hoc test was used to find the significant main effect for the Written Vocabulary Screening Device. There was a significant difference between the subjects in the systematic teaching condition (Group A) and the teacher-provided keyword condition (Group B). There were no significant main effects among the groups for the matching screening measure.

Statistical Analyses of the Data

This study had three hypotheses. They are restated below.

H1: There will be no statistically significant difference among the experimental groups on acquisition of vocabulary definitions recalled on the day after instruction has occurred.

H2: There will be no statistically significant difference among the experimental groups on short-term

Table 4-3. Summary Table for the Written Vocabulary Screening Device.

Source of Variance	df	MS	F	p
Method	2	102.62	4.52	.0192*
Error	30	22.70		

* Significant at the $p < .05$ level.

Table 4-4. Summary Table for the Matching Vocabulary Screening Device.

Source of Variance	df	MS	F	p
Method	2	43.38	2.58	.09
Error	29	16.83		

retention of vocabulary definitions recalled 1 week following instruction.

H3: There will be no statistically significant difference among the experimental groups on long-term retention of vocabulary definitions recalled 3 weeks following instruction.

The dependent variables were the subjects' recall of definitions from both a written (production) and matching (recognition) measure. The independent variables were the three interventions: (A) systematic teaching, (B) systematic teaching with a teacher-provided keyword, and (C) systematic teaching with a subject-provided keyword.

The hypotheses were analyzed two ways. The first way was an analysis of the last 3 weeks of instruction and the 1st and 3rd weeks following the end of instruction (weeks 5 and 7). The first week of instruction was not included in these analyses because two conditions had the same treatment during that week (Groups B and C). The scores for the subjects were analyzed from the 48-word written and matching measures. The subjects' scores for all of the analyses were covaried based on the subjects' Intelligence Quotient (IQ). The analysis of covariance (ANCOVA) procedure was used to determine effects. The ANCOVA with repeated measures was used to analyze the data from the last 3 weeks of instruction, and the ANCOVA was used to analyze the data from the 5th and 7th weeks of the study.

The second way the hypotheses were analyzed was using the 12 words taught during the 4th, and final, week of instruction. By the 4th week subjects had acquired familiarity, fluency, and proficiency with their intervention method. Three scores (from the 4th week of instruction, 1 week after instruction, and 3 weeks after instruction) for the subjects were analyzed by deriving subject's scores on these words from the 48-word written and matching measures.

Hypothesis 1

The first hypothesis was that there would be no significant differences for subjects' recall of definitions while they were being taught definitions of words. This is referred to as acquisition.

Written on 48 Words from Weeks 2, 3, and 4. The first hypothesis is not rejected for the written measures on 48 words from weeks 2, 3, and 4 of instruction. No main effect differences on the acquisition of definitions for the method of treatments were found on this written measure [$F(2, 33)=0.07$; $p=.9367$]. There were also no significant interaction effects [$F(4,66)=0.54$; $p=.6729$]. A summary table for these data is found in Table 4-5.

Matching on 48 Words from Weeks 2, 3, and 4. The first hypothesis is rejected for the matching measures on 48 words from weeks 2, 3, and 4 of instruction. There was not a significant main effect [$F(2, 33)=0.42$; $p=.6617$] for between

Table 4-5. Written Definitions of 48 Words from Weeks 2, 3, and 4 (Acquisition).

Source	df	SS	MS	F	p
Between Subjects:					
Method	2	33.32	16.66	0.07	.9367
IQ	1	1821.34	1821.34	7.16	
Error	33	8391.83	254.30		
Within Subjects:					
Occasion	2	6.14	3.07	0.16	.8124 (GG)
Method X Occasion	4	42.46	10.61	.54	.6729 (GG)
Occasion X IQ	2	32.44	16.22	.82	
Error	66	1304.89	19.77		

(GG: The Geisser-Greenhouse correction for the F value was performed.)

subjects, but there was a significant interaction effect [F(4, 66)=3.79; p=.0116] for within subjects. The within subjects effect is important in the repeated measures design because it is the interaction between time of measurement and treatment that is of interest.

The Geisser-Greenhouse correction to the F ratio was performed for within subjects. This correction was done to account for unequal variance among the groups across the weeks. Keppel stated that the Geisser-Greenhouse correction to the F ratios based on repeated measures "measures against a new critical value that for statistical convenience assumes the presence of maximal heterogeneity" (p. 470).

Bonferroni comparisons were used to find that during the 4th week of instruction there was a significant difference for acquisition of definitions between the teacher-provided keyword condition and both the systematic teaching and the subject-provided keyword condition. A summary table for these data is found in Table 4-6.

Written on 12 Words from Week 4. The first hypothesis is not rejected for the written measures on the 12 words taught during the 4th week. There were no main effect differences on acquisition of definitions for the instructional methods on these words [F(2, 30)=0.66; p=.5256]. A summary table for these data is found in Table 4-7.

Matching on 12 Words from Week 4. The first hypothesis is accepted for the matching measures on the 12 words taught

Table 4-6. Matching Definitions of 48 Words from Weeks 2, 3, and 4 (Acquisition).

Source	df	SS	MS	F	p
Between Subjects:					
Method	2	238.47	119.24	0.42	.6617
IQ	1	1833.75	1833.75	6.43	
Error	33	9409.19	285.127		
Within Subjects:					
Occasion	2	14.33	7.17	0.15	.8329 (GG)
Method X Occasion	4	743.62	185.90	3.79	.0116*(GG)
Occasion X IQ	2	17.44	8.72	.18	
Error	66	3233.74	49.00		

*Significant at the .05 level.
(GG: The Geisser-Greenhouse correction for the F value was performed.)

Least Squares Means (Means Adjusted for the Covariate)

	Week 2	Week 3	Week 4
A Systematic Teaching	21.44	27.04	21.78
B Teacher-Provided Keyword	19.87	26.47	36.26
C Subject-Provided Keyword	21.88	24.75	26.21

Bonferroni Comparisons

Source	df	SS	F
Method A vs C	1	114.46	2.34
Method A vs B	1	898.28	18.33*
Method B vs C	1	503.89	10.28*

*Significant at the .0167 level.

Table 4-7. Written Definitions of 12 Words from Week 4 (Acquisition).

Source	df	SS	MS	F	p
Method	2	104.77	52.39	0.66	.5256
IQ	1	118.81	118.81	1.49	
Error	30	2391.35	79.71		
Total	33	2871.88			

during the 4th week. There were no main effect differences on acquisition of definitions for the instructional methods on these words [$F(2, 30)=2.77$; $p=.0790$]. A summary table for these data is found in Table 4-8.

Hypothesis 2

The second hypothesis was that there would be no statistical differences for subjects' recall of definitions 1 week after instruction had ended. This is referred to as short-term retention.

Written on 48 Words from Week 5. The second hypothesis is not rejected for the written measures on 48 words from the 5th week. No main effect differences on the short-term retention of definitions for the method of treatments were found on this written measure [$F(2, 33)=0.76$; $p=.4762$]. A summary table for these data is found in Table 4-9.

Matching on 48 Words from Week 5. The second hypothesis is not rejected for the matching measures on 48 words from the 5th week. There were no main effect differences on the short-term retention of definitions for the method of treatments on this matching measure [$F(2, 33)=3.13$; $p=.0567$] A summary table for these data is found in Table 4-10.

Written on 12 Words from Week 5. The second hypothesis is not rejected for the written measures on the 12 words taught during the 4th week. There were no main effect differences on short-term retention of definitions for the

Table 4-8. Matching Definitions of 12 Words from Week 4 (Acquisition).

Source	df	SS	MS	F	p
Method	2	58.75	29.38	2.77	.0790
IQ	1	26.83	26.83	2.53	
Error	30	318.71	10.62		
Total	33	472.94			

Table 4-9. Written Definitions of 48 Words from Week 5 (Short-term Retention).

Source	df	SS	MS	F	p
Method	2	196.80	98.40	0.76	.4762
IQ	1	1013.20	1013.20	7.81	
Error	33	4279.32	129.68		
Total	36	6758.77			

Table 4-10. Matching Definitions of 48 Words from Week 5 (Short-term Retention).

Source	df	SS	MS	F	p
Method	2	1136.34	568.17	3.13	.0567
IQ	1	924.60	924.60	5.10	
Error	33	5980.81	181.24		
Total	36	10340.32			

instructional methods on these words [$F(2, 30)=0.87$; $p=.4273$]. A summary table for these data is found in Table 4-11.

Matching on 12 Words from Week 5. The second hypothesis is rejected for the matching measures on the 12 words taught during the 4th week. There was a significant main effect on short-term retention of definitions for the instructional methods on these words [$F(2, 30)=4.75$; $p=.0161$]. The teacher-provided keyword condition was significantly better than the systematic teaching condition [$F(1, 30)=7.56$; $p=.0100$]. Additionally, the subject-provided keyword condition was significantly better than the systematic teaching condition [$F(1,30)=6.65$; $p=.0151$]. A summary table for these data is found in Table 4-12.

Hypothesis 3

The third hypothesis was that there would be no statistical differences for subjects' recall of definitions 3 weeks after instruction had ended. This is referred to as long-term retention.

Written on 48 Words from Week 7. The third hypothesis is accepted for the written measures on 48 words from the 7th week. No main effect differences on the long-term retention of definitions for the method of treatments were found on this written measure [$F(2, 33)=1.05$; $p=.3628$]. A summary table for these data is found in Table 4-13.

Table 4-11. Written Definitions of 12 Words from Week 5 (Short-term Retention).

Source	df	SS	MS	F	p
Method	2	21.00	10.50	0.87	.4273
IQ	1	68.06	68.06	5.67	
Error	30	360.04	12.00		
Total	33	547.26			

Table 4-12. Matching Definitions of 12 Words from Week 5 (Short-term Retention).

Source	df	SS	MS	F	p
Method	2	90.65	45.33	4.75	.0161*
IQ	1	46.12	46.12	4.83	
Error	30	286.25	9.54		
Total	33	490.47			

*Significant at the .05 level.

Bonferroni Comparison

Source	df	SS	F	p
Method A vs C	1	72.10	7.56	.0100*
Method A vs B	1	63.46	6.65	.0151*
Method B vs C	1	00.10	0.01	.9192

*Significant at the .05 level.

Least Squares Means (Means Adjusted for the Covariate

A Systematic Teaching	5.66
B Teacher-Provided Keyword	9.55
C Subject-Provided Keyword	9.40

Table 4-13. Written Definitions of 48 Words from Week 7 (Long-term Retention).

Source	df	SS	MS	F	p
Method	2	316.55	158.28	1.05	.3628
IQ	1	772.91	772.91	5.11	
Error	33	4994.99	151.36		
Total	36	7296.57			

Matching on 48 Words from Week 7. The third hypothesis is not rejected for the matching measures on 48 words from the 7th week. There were no main effect differences on the short-term retention of definitions for the method of treatments on this matching measure [$F(2, 33)=3.18$; $p=.0547$] A summary table for these data is found in Table 4-14.

Written on 12 Words from Week 7. The third hypothesis is not rejected for the written measures on the 12 words taught during the 4th week. There were no main effect differences on long-term retention of definitions for the instructional methods on these words [$F(2, 30)=2.06$; $p=.1447$]. A summary table for these data is found in Table 4-15.

Matching on 12 Words from Week 7. The third hypothesis is not rejected for the matching measures on the 12 words taught during the 4th week. There were no main effect differences on long-term retention of definitions for the instructional methods on these words [$F(2, 30)=3.04$; $p=.0626$]. A summary table for these data is found in Table 4-16.

A visual display of the hypotheses acceptance or rejection is in Figure 4-1. Graphic representations of subjects' scores on the matching assessments (when significant differences were found) are displayed in Figures 4-2 and 4-3.

Table 4-14. Matching Definitions of 48 Words from Week 7 (Long-term Retention).

Source	df	SS	MS	F	p
Method	2	1106.96	553.48	3.18	.0547
IQ	1	462.86	462.86	2.66	
Error	33	5747.53	174.17		
Total	36	8967.30			

Table 4-15. Written Definitions of 12 Words from Week 7 (Long-term Retention).

Source	df	SS	MS	F	p
Method	2	48.56	24.28	2.06	.1447
IQ	1	69.82	69.82	5.93	
Error	30	352.99	11.77		
Total	33	568.38			

Table 4-16. Matching Definitions of 12 Words from Week 7 (Long-term Retention).

Source	df	SS	MS	F	p
Method	2	80.26	40.13	3.04	.0626
IQ	1	21.55	21.55	1.63	
Error	30	395.62	13.19		
Total	33	593.06			

	Acquisition H1	Short-term Retention H2	Long-term Retention H3
48 words written	NOT REJECTED	NOT REJECTED	NOT REJECTED
48 words matching	REJECTED (4th week - Teacher-provided keyword)	NOT REJECTED	NOT REJECTED
12 words written	NOT REJECTED	NOT REJECTED	NOT REJECTED
12 words matching	NOT REJECTED	REJECTED (Teacher-provided keyword and Subject-provided keyword)	NOT REJECTED

Figure 4-1
Summary of all Hypotheses Not Rejected or Rejected

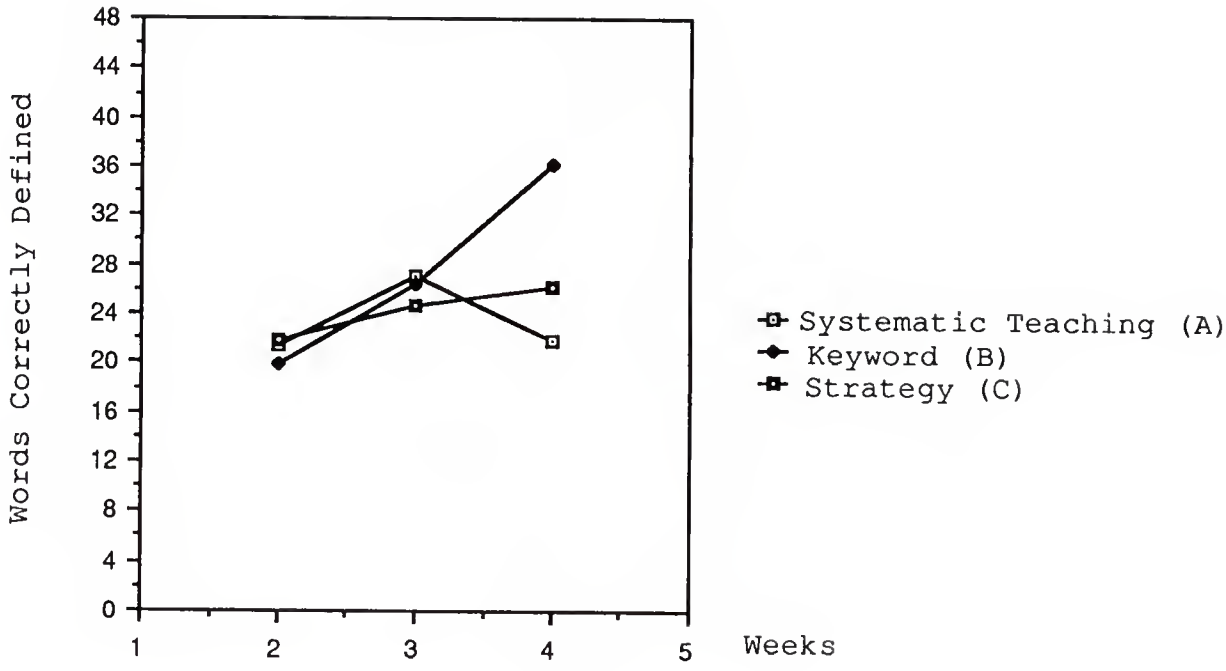

Figure 4-2
Matching Definitions of 48 Words from Weeks 2, 3, and 4

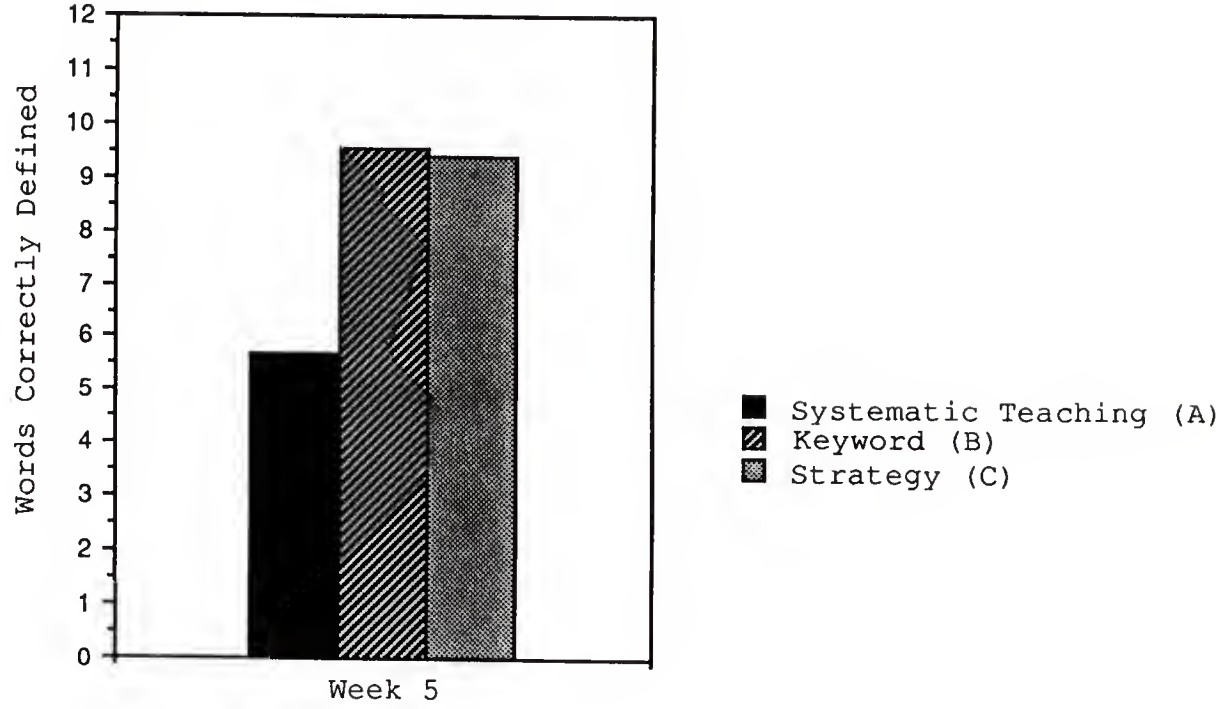

Figure 4-3
Matching Definitions of 12 Words from Week 5 (taught during Week 4)

Descriptive Analyses of the Data

Written and Matching Acquisition Description

During the first week of intervention, the subjects were instructed on the first group of 12 words (See Appendix B for a listing of the words taught during each week). Subjects in Group A recalled an average of 6 definitions on the written test and 9 definitions on the matching test. Subjects in Group B recalled an average of 6.5 definitions on the written test and 10.3 definitions on the matching test. Subjects in Group C recalled an average of 7.1 definitions on the written test and 9.2 definitions on the matching test. The results of Day 4 scores for the 12 words taught during each instructional week are presented in Table 4-17. These scores were derived from the subjects' scores on the Written and Matching Vocabulary Definition Devices. These scores are described in relation to the group's scores for the preceding and following weeks.

Subjects in Groups A and B developed a trend for the written measures during the last 3 weeks of instruction. There was a decrease in scores for the 2nd and 3rd weeks, and an increase for the 4th week. Subjects in Group C also decreased scores for the 2nd week, but then increased scores for the 3rd and 4th weeks.

Subjects in Group A increased their scores on the matching measures from the 1st to the 2nd week, but then

Table 4-17. Written and Matching Acquisition Scores.

Weeks	1	2	3	4
Written Vocabulary Definition Device:				
A				
Average	6.0	5.2	3.1	4.8
SD	2.6	3.1	3.1	4.3
Range	1.5 - 9	.5 - 11.5	0 - 10.5	0 - 12
B				
Average	6.5	5.5	5.2	8.3
SD	4.0	4.4	3.4	3.6
Range	0 - 11.5	0 - 12	0 - 12	1 - 12
C				
Average	7.1	3.3	4.5	6.1
SD	3.2	3.2	4.3	4.3
Range	1.5 - 12	0 - 11	0 - 12	0 - 12
Matching Vocabulary Definition Device:				
A				
Average	9.0	9.2	5.7	4.8
SD	3.3	3.3	4.1	3.2
Range	4 - 12	3 - 12	0 - 11	0 - 12
B				
Average	10.3	8.8	7.9	10.1
SD	2.1	4.2	4.4	2.9
Range	5 - 12	0 - 12	0 - 12	3 - 12
C				
Average	9.2	8.4	7.0	7.8
SD	2.9	3.5	4.1	3.8
Range	3 - 12	2 - 12	0 - 12	0 - 12

decreased for the 3rd and 4th weeks. Subjects in Group B seemed to follow a similar trend for their written measures. These subjects scored lower for the 2nd and 3rd weeks, but then scored higher for the 4th week. Subjects in Group C also followed the same trend as Group B on the matching measures.

Daily Rate of Acquisition Description

Immediately following each of the 3 days of instruction during the 4-week intervention period the subjects were given a Daily Quiz. The Daily Quiz for each week listed the 12 target words for that week. The subjects were allowed 5 minutes to write the definitions of the words. The average scores for each week of intervention are presented in Table 4-18.

Subjects in all conditions increased their recall of definitions for each of the Day 1, 2, and 3 Daily Quizzes during each of the 4 weeks of intervention, except for Group A during the 3rd week. For subjects in all conditions, with one exception, the Day 3 Daily Quiz average was higher than the Day 4 Written Vocabulary Definition Device. There was only one occasion in which the subjects increased their recall of definitions on the Day 4 Written Vocabulary Definition Device. The 1st week of intervention for Group C (which had Group B intervention during the 1st week) increased from a 6.6 recall on Day 3 to a 7.1 on Day 4. The Day 4 measure was given 24 hours after the 3-day instructional sessions, whereas the

Table 4-18. Daily Rate of Acquisition Scores.

Weeks:	1st			2nd			3rd			4th		
Days:	1	2	3	1	2	3	1	2	3	1	2	3
A												
Average	4.0	5.5	6.5	2.0	4.3	6.4	2.5	1.9	4.5	4.7	6.9	7.8
B												
Average	3.4	5.3	7.3	3.1	5.1	6.9	2.6	4.4	7.4	5.7	8.4	9.7
C												
Average	2.5	4.4	6.6	1.5	2.5	3.8	1.6	5.0	5.8	3.3	6.3	7.9

Daily Quizzes were given immediately following each of the 3 days of instruction for each week.

Related Findings

Previous researchers have found that students who are taught using the keyword mnemonic method recall more information than students taught using other methods. Some of the results from this study are similar findings because subjects taught using the keyword method recalled significantly more definitions on some of the matching measures used in this study. On the 48-word matching measure during week 4, the subjects in the teacher-provided keyword condition recalled significantly more than subjects in the other two conditions. This was during the acquisition stage--when subjects were learning definitions of words. On the 12-word matching measure during week 5, the subjects in the teacher-provided keyword condition recalled significantly more than subjects in the other two conditions. Furthermore, the subjects in the subject-provided keyword condition recalled significantly more than the subjects in the systematic teaching condition. This was during the short-term retention stage--when subjects were remembering the definitions of words that they had been taught the week before.

Summary

Subjects in the systematic teaching with teacher-provided keyword condition recalled significantly more than subjects in the other two conditions on acquisition and short-term retention when assessed with the matching measures. Subjects in the systematic teaching with subject-provided keyword condition recalled significantly more than subjects in the systematic teaching condition on short-term retention when assessed with the matching measure. A discussion of these results is reported in Chapter V.

CHAPTER V
DISCUSSION

The purpose of this chapter is to summarize the results of this research. Statistical and descriptive discussions of each hypothesis are presented. Practical considerations are stated. Each of the phases of this study is discussed. In addition, feedback from teachers and students who participated in this research is reported. Educational implications and future research needs are reported.

Discussions of Hypotheses

Hypothesis 1

The first hypothesis was that there would be no statistical differences while subjects were learning the definitions of the words. This was referred to as acquisition of definitions. The subjects' recall on the written measures (both 12- and 48-word scores) did not result in significant results. The subjects' recall on matching measures of the 48-word matching measure indicated a significant difference for subjects in the teacher-provided keyword condition during the 4th week of intervention. There were no other significant results for the subjects' recall on matching measures for acquisition of definitions.

Hypothesis 2

The second hypothesis was that there would be no statistical differences 1 week after the end of instruction. This was referred to as short-term retention of definitions. The subjects' recall on the written measures (both 12- and 48-word scores) did not result in significant results. The subjects' recall on the 12-word matching measure during the 5th week of this study indicated that the recall of subjects in the teacher-provided keyword condition was significantly better than the recall of subjects in the other two conditions. In addition, the subjects in the subject-provided keyword condition recalled significantly more than the subjects in the systematic teaching condition. There were no other significant results for the subjects' recall on matching measures for short-term retention of definitions.

Hypothesis 3

The third hypothesis was that there would be no statistical differences 3 weeks after the end of instruction. This was referred to as long-term retention of definitions. The subjects' recall on the written measures (both 12- and 48-word scores) did not indicate significant results. The subjects' recall on the matching measures (both 12- and 48-word scores) also did not indicate significant results.

ummary

Subjects in all conditions were learning and remembering efinitions of previously unfamiliar words. Although tatistical analyses did not result in significant fferences for each of the four ways that each hypothesis as examined, the significant results that were obtained for he matching measures (during weeks 4 and 5) add to the xisting literature that supports the effectiveness of the mposed keyword method. Additionally, the significant esults obtained during the 5th week of this study (short-erm retention) for the subject-provided keyword condition ersus the systematic teaching condition are an indication of reviously unexplored effectiveness of the induced keyword ethod.

Practical Considerations

The imposed method of keyword mnemonics has been vestigated extensively with the mildly handicapped pulation. Results of these investigations have indicated at when students are taught new vocabulary definitions ing a keyword and interactive illustration that has been ovided to them that the students remember more definitions an when instructed using similar materials (i.e., visual d of the vocabulary term, its definition, and picture of e definition--but without the keyword that interacts with

the picture of the definition). All three conditions investigated in this study incorporated direct instruction and effective teaching techniques as a part of the interventions, but the imposed keyword method and induced keyword method resulted in greater recall of definitions when students were assessed using the matching format during acquisition and short-term retention stages.

Since the imposed keyword method has been effective and has resulted in greater recall of definitions than other methods of vocabulary instruction (e.g., free study, sentence context), it seems prudent that investigators continue to research other mnemonic techniques (e.g., mimetic mnemonics) and to translate that research into instructional techniques that can be used by teachers. Indeed, this type of research is currently being investigated using social studies texts and other curricular materials that have been revised to include various types of mnemonics to aid students in recalling factual information (Mastropieri & Scruggs, 1989). Students report learning more when instructed using mnemonic methods, and enjoy mnemonic instruction more than traditional teaching.

Moreover, since one of the goals of instruction is to facilitate the process whereby the learner becomes more self-reliant, then it also seems prudent to research ways for this goal to occur. That has been the purpose of this study--to

investigate whether or not mildly handicapped students can learn to use the keyword mnemonic method independently. The induced method can promote independent learning since the students make up their own keyword and imagine interactions of the vocabulary definitions with the keywords.

The results of this study indicate that students can learn to use a strategy that enables them to use the induced method of keyword mnemonics. Because no statistical differences were found for the subject-provided keyword in several of the analyses conducted in this investigation, an implication is that comparable learning occurred among all three conditions. This finding should be interpreted cautiously in view of the fact that some of the matching assessment statistics approached significance.

Discussion of the Study's Phases

Screening (Phase One)

The first aspect of screening was to determine whether students could write definitions of words when they knew the definitions. Students who participated in this research indicated that they were capable of writing definitions of simple words such as table, eat, and purse. Because students could write definitions of simple words, then it was presumed that, if they knew the definitions of more difficult words, they could write those definitions. In addition, a matching

measure was used during the screening to determine students' recall on a recognition (matching) measure.

The purpose of both screening measures was to ascertain that students did not know the definitions of the words targeted for this study. The students who participated in this study knew less than 19 (which was the cut-off score) out of the 48 words that they were taught. The results of the written and matching screenings were sufficiently low to indicate that the majority of the words and definitions were unknown to the students. Thus, the assumption was that learning was possible for the students.

In addition, the students were required to commit themselves to this study and indicate their willingness to participate by signing a written statement that indicated this motivation. Levin et al. (1979) stated that appropriate motivation was an important component of effective instruction. The students' recall on the written and matching measures throughout the study is further evidence that learning was occurring.

Teacher Training (Phase Two)

The teacher training that occurred prior to the study's implementation was conducted over a 3-week period for a total of six hours. Initially, the teachers were instructed using a lecture format. Components of the interventions that were

common to all of the interventions were discussed during those times. These components were:

1. The use of an advance organizer, demonstration, modeling, and guided practice stage was in the script for each intervention. Evaluation, both daily and weekly, was the same for all groups.

2. A review of the pronunciations and definitions for the science terms occurred.

3. A discussion of the use of PEP (prompts, evaluation, and positive reinforcement) during instruction was stated so that each teacher understood when and how to use PEP (e.g., in order to prompt the correct response from a student).

After each teacher was randomly assigned to a condition, the teachers practiced individually or in small groups with the materials and script for their corresponding intervention. The final teacher training meeting consisted of the teachers' role-playing their intervention while two observers rated the teacher regarding predetermined appropriate behaviors (i.e., following the script, following the sequence of the script, fluent pacing, and using materials correctly). The high overall percent of agreement between the two observers--93% agreement--prior to the study's implementation phase is an indication of the teachers' ability to correctly implement the intervention

according to the scripted lesson format. In addition, the interobserver agreement increased during the study's implementation phase to 95%.

Although the six hours of teacher training seemed to suffice for introduction, practice, and interobserver evaluation of the interventions, it must be noted that the teachers did practice their corresponding intervention during times other than the teacher training sessions. Moreover, the teacher who implemented the subject-provided keyword condition actually was responsible for learning two interventions since she implemented the teacher-provided keyword condition during the 1st week of the study. Each of the three teachers who implemented these interventions were already familiar with scripted lesson formats because they were using a reading program that emphasized scripted lesson formats with their students.

The interventions that were used in this study were among the first to be used on a large-class basis with the students' teachers implementing the intervention. Condus et al. (1986) implemented interventions that were similar to the systematic teaching and teacher-provided keyword conditions with smaller groups of students (e.g., two to four students). The teachers who conducted the present investigation taught two classes of their students, and the classes ranged in size from 10 to 18.

The teachers who participated in this study had volunteered to implement a research intervention. An implication of these teachers' willingness to conduct research with their students was that the teachers were already effective teachers. That is, an amount of professional and personal effort was involved in each teacher's willingness and ability to learn and implement a new and different instructional technique. Each teacher was recommended to this investigator as a capable and effective teacher. The fact that all of the teachers who conducted this research volunteered to participate also seemed to be evidence of their dedication to their students' education. This may have been a factor that increased the students' learning.

This investigator provided reinforcement for the teachers who participated in this research by sending weekly memos and gifts throughout the weeks of the study. For example, on the first day of the implementation of this study this investigator sent each teacher flowers and a message that prompted motivation from the teachers. A personal note expressing appreciation to the teachers for participating in this study and an official letter of appreciation that was sent to each teacher's principal are other examples of reinforcement given to the teachers during this study.

The average years of teaching experience for the three teachers was five years. The teachers had undergraduate degrees in special education. One of the teachers was also completing coursework for a masters degree in special education.

Instructional Implementation (Phase Three)

The teachers implemented their corresponding condition over a period of 4 weeks. During each of the weeks, 12 different science terms were targeted for instruction. The students were instructed for 3 days, and then they were tested on the 4th day. This sequence was followed for each of the 4 instructional implementation weeks. During these weeks, the students were acquiring knowledge of the terms and definitions, i.e., acquisition. The Written and Matching Vocabulary Definition Devices administered during these weeks were measures of the students' recall 24 hours after the last instructional day on those words.

Short-term retention was measured 1 week following the end of all instruction. Long-term retention was measured 3 weeks following the end of all instruction. More and more words were being taught to the students each week. The students' memory of definitions was cumulatively measured with the Written and Matching Vocabulary Definition Devices. The teachers reported that their students required more time to complete these measures as the weeks progressed. The

teachers stated that the last measures administered (3 weeks after instruction had ended) required the greatest amount of time for the students to complete.

This investigator observed each teacher one time prior to the occasions when interobserver reliability were determined. These informal observations indicated to this investigator that teachers were implementing their intervention according to the scripted lesson format and were making appropriate use of prompts, evaluation of student's responses, and positive reinforcement.

Measurement (Phase Four)

The measurement of students' recall of definitions occurred 24 hours following the instruction for each of the 4 intervention weeks, 1 week following the completion of intervention, and 3 weeks following completion of intervention. Both production (written) and recognition (matching) measures were used to determine and compare subjects' recall of definitions. The Written and Matching Vocabulary Definition Devices were used for each measurement occasion.

Some reseachers who have conducted prior studies with keyword mnemonics have measured students' recall by having students tell the experimenters the definitions of words. The verbal responses from the students may have resulted in higher scores for those students since deficits in

handwriting and spelling could impact on students' abilities to write definitions. The graduate students who scored the written measures for this study did comment that handwriting was not always clearly legible and that spellings were frequently phonetic rather than correct. However, the graduate students stated that they were able to decipher written definitions in spite of misformed letters and misspelled words. The students received full, partial, or no credit for the written definitions (1 point, .5 point, or no point). For example, the correct definition of crater is an "opening at the top of a volcano." Partial credit was given for written responses such as "a volcano with a hole in it," or "opening of a volcano." The correct definition for hypothesis was "a possible explanation." Full credit was given for "an educated guess" and partial credit was given for "lots of ideas."

Because the students were learning more definitions each week, the teachers reported that they challenged their students to continue to remember the definitions from words taught during prior weeks. In addition to the positive challenge that was presented by the teachers, high expectations were verbalized to the students. Also, the written daily quizzes on 12 words during the instructional weeks may have helped the students to become more adept on the written tests on 48 words at the end of each

instructional week. The students received practice with this portion of assessment throughout the instructional intervention weeks.

It is important to recognize that none of the subjects' written measures resulted in significant differences among any of the conditions. Because written communication is a very complex level of communication, it may be that students need to first master verbal and cued methods of assessment and then a written method of assessment. The cued method of assessment was used in this study by the matching measures. Implications for writing skills are stated under Educational Implications.

The decline of subjects' recall of definitions as measured by the matching assessments for the subjects in the systematic teaching condition is also of interest. According to Atkinson and Shiffrin's memory theory (1968), the short-term and long-term retention of information is dependent on the way that students choose to remember information. Although these subjects were instructed with a method considered to be the best alternative method of instruction, it seems evident that the students were not capable of choosing an efficient method of remembering an increasing number of words and definitions across time. When these subjects' scores are compared to the subjects' scores in the other two conditions, it seems evident that a keyword

mnemonic method or a strategy that helps students to learn to use the keyword mnemonic method independently gives the students a choice of effective methods that help them to learn and remember increasing amounts of information over longer periods of time.

Feedback from Students and Teachers

Students

This investigator informally interviewed some students from each condition. Due to time constraints because of the ending of the school year, all students in each condition were not interviewed. Approximately 12 students from the systematic teaching and teacher-provided keyword conditions were interviewed as a group, and three students from the subject-provided keyword condition were interviewed individually. All students interviewed stated that they had enjoyed the way their teacher had taught them the 48 words.

The students from the systematic teaching condition stated that they preferred the "new way" of learning words and definitions as opposed to looking words up in the dictionary. These students seemed pleased that they were exposed to a different way of learning definitions. The students said they thought they learned and remembered more definitions when their teacher used the systematic teaching method. Several students also stated that a few of the words

were being taught in their science classes. When asked how they felt that they knew those words and definitions, the students commented that "It felt good," "I could understand," and "I felt smart."

The students who participated in the teacher-provided keyword condition also expressed satisfaction with the method their teacher had used to teach them words and definitions. Some students stated that they might use the keyword method independently in the future, but also said that it might be difficult for them to think of their own keywords at first.

The students who participated in the subject-provided keyword condition clearly indicated that it was more difficult for them to think of keywords and imagine interactive illustrations when they initially began learning and using the IT FITS strategy. One student who was interviewed used his 3" X 5" cards to cue him for the words and his keywords. He proceeded to tell this investigator approximately 20 words, their definitions, his keywords, and how he imagined his keywords and words doing something together. At times during the interview, he would pause and ask this investigator, "How'd you like that?" and "Pretty slick, huh?." He seemed pleased with how the IT FITS strategy had helped him, and stated that he had taught it to his younger sister when she needed some help with learning

science definitions. He said that he would use the strategy in the future.

Other students who participated in the subject-provided keyword condition also stated that they would use the strategy in the future to help them learn and remember definitions. All students who were interviewed said that they had used the keyword and their imagined interactions to help them remember definitions of terms.

In summary, students in each condition seemed pleased with their method of instruction. The instruction was conducted in the students' class setting by their classroom teacher. All students who were interviewed stated that they were glad that they participated in this research study and that they had benefited by learning new words and definitions. Some students stated that they thought their handwriting and spelling had improved as a result of having to write so many definitions on numerous occasions. Indeed, the students interviewed seemed anxious to let this investigator know how much they had learned by telling her terms and definitions. Students thanked this investigator for "giving the words" to them.

Teachers

The teachers who participated in this investigation also expressed satisfaction with the intervention they had conducted. During an informal meeting among all of the

teachers and this investigator at the conclusion of the research, each teacher demonstrated their intervention. Because each teacher was unaware of what the other interventions were, the teachers seemed particularly interested in the methods of the other two teachers' interventions.

Prior to knowledge of the other two conditions, the teacher who implemented the systematic teaching condition had stated that she would definitely use the systematic teaching method in the future. After seeing a demonstration of the teacher-provided keyword condition and the scores that those students had earned, she stated that she would use the keyword method because it seemed to be a more efficient and effective method over a longer period of time than the systematic teaching method alone. She also indicated that after sufficient demonstration of the keyword method, she would consider teaching her students the IT FITS strategy so that they could use the keyword method independently.

The teacher who implemented the teacher-provided keyword condition was also satisfied with her intervention. She stated that her students had enjoyed this method of instruction and had benefited from participation in this study. The subjects' scores are indicative of the success that they experienced with this mnemonic method.

The teacher who implemented the subject-provided keyword condition did not begin that intervention until the 2nd week of this study. During the 1st week the students had received the same instruction as the students in the teacher-provided keyword condition. This was done to allow the students sufficient time to see the keyword method demonstrated and to understand the keyword method. The teacher stated that her students were surprised during the 2nd week of the study when she began a different way of teaching them. The teacher said that the students had the most difficulty during this week when they began using the keyword method independently. As the weeks progressed (the 3rd and 4th weeks of the instruction) the teacher stated that her students seemed to become more adept when they were applying the IT FITS strategy. These statements are also reflected in the students' scores for daily acquisition, as well as in their written and matching scores for the 2nd week. However, as the weeks progressed the students' scores continued to increase. This teacher also commented that the subject-provided keyword condition was less structured than the other two conditions, and that her students seemed to need an amount of time to understand that they were "on their own," and that she was not able to help them except by emphasizing and encouraging the use of the strategy.

In summary, all teachers expressed satisfaction with the intervention that they had implemented. All teachers felt that their students had learned and had benefited from participation in this study.

Educational Implications

Teacher and student satisfaction with all conditions in this study is evidence that, when research is conducted in the schools by teachers, effective interventions should be presented by researchers. This is important because experiments conducted by investigators, both in the schools and in laboratory settings, may not be incorporating all of the issues that classroom teachers encounter in the real-world setting of the schools. Levin et al. (1979) stressed the importance of conducting experiments in school settings to determine whether effectiveness of interventions would diminish. The present study continued the research that Mastropieri, Scruggs, McLoone, and Condus have conducted in the schools and included a component that had yet to be researched--whether mildly handicapped students could learn to use the keyword method independently. Results from the short-term retention matching measure indicate that students in the subject-provided keyword condition recalled significantly more than students in the systematic teaching condition. Statistically, there were no other significant

differences favoring the subject-provided keyword condition students. It appears that mildly handicapped students can learn to use the keyword method independently, and that the strategy used by the subject-provided keyword students resulted in a level of retention that compared favorably with the level achieved by students in the systematic teaching condition.

Input from the teachers and the students should be considered so that research is applicable to their teaching and learning needs. The science words taught during this study were from a tenth grade general science text. This level of vocabulary words was used to ensure that the words were difficult and unfamiliar. Although some of these terms are also taught at other grade levels, the students' initial unfamiliarity of these terms was determined during the screening procedures. Moreover, the students in all conditions indicated by their scores that they were capable of learning words and definitions that were taught above their grade level in school.

When the academic task is to learn definitions of unfamiliar words, teachers should consider using the teacher-provided keyword mnemonic method and the subject-provided keyword mnemonic method. Teacher-provided keywords should be used initially to demonstrate and model this method with students. Next, teachers should consider teaching the IT

FITS strategy so that students can become adept at using the strategy independently. These methods should not be considered as the sole method of instruction, but as alternative methods of instruction that can enhance students' memory, academic performance, and independence when the learning task is to remember definitions of unfamiliar words.

In addition, student learning styles and individual characteristics should be considered. If a student already has an effective and efficient way of remembering definitions of new words, then the student may not benefit from learning a new method or using a strategy. However, the students in this study reported that they did not use keyword mnemonics or a strategy to help them remember definitions prior to the implementation of this study.

Lorayne and Lucas (1974) emphasized that a strength of a student's independent use of the keyword mnemonic method is that the keyword and interactive illustration are unique to the student. That is, what a student thinks of for the keyword and the interaction is meaningful to that student. The students in the subject-provided keyword demonstrated this uniqueness and meaningfulness. For example, one student thought of a keyword for "acoustic" that was the same as the keyword that was used for the teacher-provided keyword condition--"stick." However, the student in the subject-provided keyword condition used a different interaction of

"acoustic" and "stick" to help him remember the definition. "Acoustic" means "having to do with hearing," and the student associated "acoustic" with the stick that his bandleader used. He said that he remembered the definition because the stick that his bandleader used made a noise when it was tapped.

Other students in the subject-provided keyword condition thought of keywords and interactions that this investigator hopes to use in future research. In particular, a student thought of a way to distinguish "cerebrum" (which is the largest part of the brain) from "cerebellum" (which is the smaller part of the brain located below the cerebrum). His keyword for "cerebrum" was "drum," and his keyword for "cerebellum" was "bell." He stated that because a drum was usually larger than a bell, it was easier for him to remember the larger part of the brain as the cerebrum and the smaller part of the brain as the cerebellum. The students who reported their keywords and interactions to this investigator seemed to be using the three Rs that Levin (1983) referred to: recoding unfamiliar words into familiar words, relating the familiar words to the definition of the unfamiliar words, and retrieving the definition of the unfamiliar word by using the recoded keyword.

Additionally, students in the subject-provided keyword condition did not always use an acoustic link for their

keyword. For example, several students used "ravioli" as the keyword for "alveoli" because the words ended the same, although they are pronounced differently. Other students used an acoustic link from a word in the definition when they could not think of a keyword with an acoustic link with the vocabulary term. For example, one student's keyword for "retina" was "film", which begins with the same sound as "forms." According to the student, "a film projection is like the retina because the retina is the back part of the eye where an image forms."

The following research methods and questions warrant further investigation to more fully determine the merits of students learning a strategy so that they can use the keyword mnemonic method independently.

1. Replication of this study with different mildly handicapped populations and in different geographical areas would increase the external validity of this investigation.

2. Assignment of more than one teacher to each intervention that was investigated in this study would help to control for teacher variables that could impact on the effectiveness of each intervention.

3. Measurement of students' recall of definitions by also using a verbal response (so that writing and reading deficits that students may have are accommodated for) should be explored.

4. Continuation of research in school settings with teachers implementing similar interventions so that valuable input from teachers and students can be used to make appropriate changes in research procedures.

5. Continuation of research in school settings using the methods investigated in this study, but with emphasis on content that students are learning in their curriculum would help to ensure that functional units of instruction are being taught.

6. Emphasis on students using a strategy (e.g., IT FITS) to help them learn how to use the keyword mnemonic method independently should be investigated.

7. Exploration of generalization effects to determine whether students can learn to use the strategy with other words and in other settings should be investigated, as well as an increase in weeks of research so that more long-term effects can be explored.

In summary, the mildly handicapped students who participated in this investigation benefited from all interventions. The students in the teacher-provided keyword condition learned more than the students in the other conditions on the acquisition and short-term retention matching measures. The students in the subject-provided keyword condition learned more than the students in the systematic teaching condition on the short-term retention

matching measure. Because the subject-provided keyword students learned independently and with less teacher direction than the students in the other two conditions, teaching mildly handicapped students a strategy that helps them to use the keyword mnemonic method independently warrants further investigation.

APPENDIX A
LISTING OF WORDS USED DURING SCREENING

alveoli	artery	capillaries
cerebellum	cerebrum	chromosomes
esophagus	ligaments	medulla
tendons	trachea	villi
acoustic	retina	adrenalin
vertebrae	hormone	biomes
extinct	fossil	habitat
hibernation	hybrid	instincts
niche	respiration	prey
predator	stimulus	camouflage
flagellum	organism	species
hypothesis	velocity	aquifer
crater	crystal	cyclone
delta	epicenter	erosion
leeward	meanders	nodules
sediment	seismograph	sonar
topographic map	humus	catalyst
diffusion	soluble	axis
continents	crust	drought
latitude	cape	divide
oasis	boundary	earthquake
escarpment	elevation	atmosphere
compost	tributary	fault
biosphere	fjord	anemometer
concave	condensation	convex
constellation	cosmic	evaporation
galaxies	nebulla	opaque
ozone	supernova	transparent
eclipse	aurora	incandescent
precipitate	translucent	skeleton

APPENDIX B
EXAMPLES OF DAILY QUIZ AND WRITTEN VOCABULARY DEFINITION DEVICES

Weather, Astronomy, & General Science Terms

transparent -

eclipse -

precipitate -

translucent -

evaporation -

galaxies -

nebulla -

supernova -

anemometer -

concave -

condensation -

constellation -

Animal, Plant Life, & General Science Terms

respiration -

velocity -

hypothesis -

flagellum -

camouflage -

stimulus -

niche -

instincts -

habitat -

fossil -

extinct -

biomes -

Earth Science & General Science Terms

diffusion -

seismograph -

erosion -

crater -

topographic map -

meanders -

cyclone -

aquifer -

soluble -

sonar -

leeward -

crystal -

Body Terms & General Science Terms

villi -

acoustic -

retina -

hormone -

cerebrum -

esophagus -

ligaments -

medulla -

alveoli -

artery -

capillaries -

cerebellum -

APPENDIX C
EXAMPLE OF MATCHING VOCABULARY DEFINITION DEVICE

BODY TERMS AND GENERAL SCIENCE TERMS

Term	Definition
_____villi	A. having to do with hearing
_____artery	B. largest part of the brain
_____capillaries	C. long tube that connects the throat and the stomach
_____cerebellum	D. blood vessels that carry blood away from the heart
_____cerebrum	E. part of the brain that controls involuntary actions
_____hormone	F. tiny finger-like projections in the small intestine
_____esophagus	G. a chemical produced within the body
_____ligaments	H. tissue that holds bones together
_____medulla	I. air sac in the lungs
_____retina	J. back part of the eye where an image forms
_____acoustic	K. part of the brain just below the cerebrum
_____alveoli	L. very small blood vessels

WEATHER, ASTRONOMY, AND GENERAL SCIENCE TERMS

Term	Definition
_____supernova	A. casting a shadow
_____concave	B. star that explodes
_____condensation	C. some light can pass through
_____constellation	D. changing from a liquid to a gas
_____galaxies	E. a device for measuring the speed of the wind
_____precipitate	F. fall as rain, sleet, snow
_____evaporation	G. groups of billions of stars
_____translucent	H. curving inward
_____nebulla	I. changing from a gas to a liquid
_____eclipse	J. a huge cloud of gas and dust in which stars form
_____transparent	K. pattern of stars
_____anemometer	L. almost all light passes through

EARTH SCIENCE AND GENERAL SCIENCE TERMS

Terms	Definitions
_____seismograph	A. solid form of minerals
_____crater	B. capable of being dissolved into a liquid
_____crystal	C. the wearing away of the earth's surface
_____erosion	D. a large whirling wind
_____meanders	E. layers of rock where ground water is stored
_____diffusion	F. looping curves in a river
_____cyclone	G. recording device that detects an earthquake
_____leeward	H. map that shows the suface features of an area
_____soluble	I. device that sends out sound waves in water
_____topographic map	J. opening at the top of a volcano
_____sonar	K. facing away from the wind
_____aquifer	L. spreading out in all directions

ANIMAL AND PLANT LIFE AND GENERAL SCIENCE TERMS

Term	Definition
_____stimulus	A. evidence of formerly living things
_____extinct	B. natural behaviors that a living thing is born with
_____fossil	C. something that causes a living thing to react
_____niche	D. place where an organism lives
_____velocity	E. large land areas where specific animals live
_____hypothesis	F. a whip-like organ that propels certain one-celled animals
_____instincts	G. a possible explanation
_____habitat	H. the process of breathing
_____respiration	I. a coloration or pattern that can disguise
_____flagellum	J. way of living of a species within a habitat
_____camouflage	K. speed of an object
_____biomes	L. no longer existing

APPENDIX D
EXAMPLES OF CARDS USED WITH EACH INTERVENTION

biomes

large land areas where specific animals live

biomes (homes)

large land areas where specific animals live

© 1989 Peggy King Sears

biomes

large land areas where specific animals live

APPENDIX E
SUBJECT CONSENT FORM

Subject Name_____

Date_____

School_____

Classroom Teacher_____

My teacher has explained to me that I have the opportunity to learn definitions of words that I do not know. I would like to participate in this learning experience, and my signature below indicates my willingness to do so. I understand that the weekly test on the definitions will count towards my overall grade in this class. My scores will be kept confidential except for my classroom teacher, the person who grades the tests, and Peggy King.

I want to learn definitions of words that I do not know.

_____
(Student Signature) (Date)

_____
(Classroom Teacher Signature) (Date)

_____
(Principal Investigator Signature) (Date)
Margaret (Peggy) E. King

APPENDIX F
TEACHER TRAINING PROCEDURES

I. Provide Introduction and Advance Organizer
   A. Goals for training
   B. Expectations for progress during training
   C. Format for training procedures

II. Introduce Vocabulary Definition Learning Models and Instruction Methods
   A. Identify research methods that have been effective
   B. Describe characteristics of systematic teaching
      1. Advance organizer
      2. Demostration
      3. Modeling
      4. Guided practice/independent practice
      5. Evaluation
   C. Describe characteristics of effective teacher behaviors
      1. Prompting for responses
      2. Evaluating responses by immediate and corrective feedback
      3. Positively reinforcing responses

III. Random Assignment of Teachers to Conditons

IV. Provide Individual Demonstration of Conditions

V. Provide Individual Guided and Independent Practice

VI. Observe and Assess Teacher Performance using Time Sampling Form

APPENDIX G
TIME SAMPLING RECORDING FORM

Teacher_____ Observer_____

	30	60	30	60	30	60	30	60
1. Following Script								
2. Following Sequence								
3. Fluent Pacing								
4. Using Materials Correctly								

	30	60	30	60	30	60	30	60
1. Following Script								
2. Following Sequence								
3. Fluent Pacing								
4. Using Materials Correctly								

	30	60	30	60	30	60	30	60
1. Following Script								
2. Following Sequence								
3. Fluent Pacing								
4. Using Materials Correctly								

Source: Adapted from Peterson, S.K. (1988). The concrete to abstract mathematical instructional sequence with learning disabled students (Doctoral dissertation, University of Florida, 1988). Dissertation Abstracts International, 48, 2040-A.

APPENDIX H
SYSTEMATIC TEACHING CONDITION TEACHER SCRIPT

Directions for Vocabulary Screening Devices

Today you will be taking a test on definitions of vocabulary words. There are many words on these pages. You may not recognize many words, and you may not know the definitions for many words. That is OK. Find the words that you know and write the definitions for those words. This test will not count towards your grade in this class. Do not worry about correct spelling, but be sure to write a complete definition for the words that you do know. (Distribute a form of the Written Vocabulary Screening Device.)

Write your name, my name, and today's date at the top of the page. (Pause for approximately one minute. You may want to have that day's date and your name written on the board for the students to copy.) **There is no time limit for this test. Raise your hand when you have written the definitions for as many words as you can. Are there any questions?** (Answer any questions.) **Ready. Begin.** (Collect the papers when the students finish writing definitions. Distribute the Matching Vocabulary Screening Devices. Directions are on the test.)

(NOTE: Vary the beginning sentence for the second and third occasions that the students fill out the screening

device, i.e., "Today you will be taking another test on definitions of vocabulary words.")

Materials needed for Instructional Implementation Weeks 1, 2, 3, and 4

1. Cards with the vocabulary term, its definition, and a picture of the definition printed on them. Three cards will be used for examples, and the remaining 12 cards will be the targeted words for that week of instruction.

2. A cassette recorder and timer to indicate lesson and daily evaluation lengths.

Advance Organizer - Day 1 (Begin tape in cassette recorder)

Today I am going to help you learn the meanings of some vocabulary words. We will spend some time today, tomorrow, and the next day learning the meanings of these words. You will take a quiz at the end of each of these lessons to see how many you have learned, and then you will take a test on Thursday to see how many you have remembered. The test on Thursday will count towards your grade in this class. (Ask questions such as "What are we going to do today?" "When will you take the quiz?" "When will you take the test?" "What will the Thursday test count towards?" Provide PEP when necessary.)

(NOTE: Vary the beginning sentence of the advance organizer for the second, third, and fourth weeks of instruction, i.e., "This week we will continue learning the meanings of some vocabulary terms.")

Demonstration - Day 1

Now we are ready to begin studying the words and their definitions. The best way to begin is to give you practice learning some example words. (Show first example card.)

Say the word means state the definition. What does say the word mean? (Give corrective feedback, positive reinforcement, and prompts when necessary. Call on different students to respond to assure that all studends are actively involved.) **Think about this picture of describe illustration to help you remember what say the word means. Think about what? What does say the word mean?**

Modeling - Day 1

1. **The next word we are going to study is say the word.**
2. **What is the next word,** (call student name)?
3. **Say the word means state the definition.**
4. **What does say the word mean,** (call student name)?
5. **Think about this picture of describe illustration to help you remember what say the word means.**
6. **Think about what,** (call student name)?
7. **What does say the word mean,** (call student name)?

Let's try one last word. (Repeat steps 1 through 7.)

(Review the example words three times, or as long as time allows. Randomize the order by shuffling the cards each time.)

Study Phase - Guided Practice - Days 1,2, and 3

Now we will begin learning the words for the quizzes and test. (Follow the same procedure as for the example words. Be sure to use prompts, immediate and corrective feedback, and positive reinforcement when necessary.)

1. **The next word we are going to study is <u>say the word.</u>**
2. **What is the next word,** (call student name)?
3. **<u>Say the word</u> means <u>state the definition</u>.**
4. **What does <u>say the word</u> mean,** (call student name)?
5. **Think about this picture of <u>describe illustration</u> to help you remember what <u>say the word</u> means.**
6. **Think about what,** (call student name)?
7. **What does <u>say the word</u> mean,** (call student name)?

Let's try one last word. (Repeat steps 1 through 7.)

Advance Organizer - Days 2 and 3

Today you will continue learning the definitions of some words. We will do this the same way that we did it yesterday. Remember, there is a 5 minute quiz at the end of today's lesson, and there will be

a test on Thursday that will count towards your grade in this class. Let's start. (Proceed with the Study Phase - Guided Practice for Days 1, 2, and 3.)

Evaluation - Daily

Our time for today's instruction on these words is over. Now you need to write as many definitions as you can remember. (Distribute a form of the Daily Measure of Vocabulary Definition Device.) **Write your name, my name, and today's date at the top of this page.** (Pause for approximately one minute. You may want to write that day's date and your name on the board so that the students can copy it.)

Follow along as I read the directions at the top of the page. Listen. Find the words that you know. Write the definitions next to the words.

I need to tell you one more thing about this quiz. Spelling does not count, but be sure to write a complete definition of the words that you do know.

You will have 5 minutes. Are there any questions? (Answer any questions.) **Ready. Begin.**

(Begin timer for 5 minutes. At the end of 5 minutes collect the students' papers. When appropriate, you may want to make a statement of praise regarding the students' behaviors and cooperation at the conclusion of each day's lesson and daily quiz.)

Evaluation - Weekly

Today you are going to take a test on the words you have been learning. (Distribute a form of the Written Vocabulary Definition Device.) **Write your name, my name, and today's date at the top of the page.** (Pause for approximately one minute. You may want to have your name and that day's date written on the board for the students to copy.)

Now think about the words you have learned and try hard to remember the meanings of the words. On this test there may be words that you do not know or remember the meanings of; do not worry about them. Skip the words you do not know and find the words you can define. Write the meanings of those words. Spelling does not count on this test, but be sure to write a complete definition of the words that you do know. There is no time limit for today's test.

Remember that today's test counts towards your grade in this class. Are there any questions? (Answer any questions.) **Ready. Begin.** (Collect the papers as the students are finished. At the conclusion of the weekly evaluation you may want to make some statement of praise regarding the students' performance and cooperation during that week's instructional sessions.)

APPENDIX I
SYSTEMATIC TEACHING WITH A TEACHER-PROVIDED KEYWORD MNEMONIC CONDITION TEACHER SCRIPT

Directions for Vocabulary Screening Devices

Today you will be taking a test on definitions of vocabulary words. There are many words on these pages. You may not recognize many words, and you may not know the definitions for many words. That is OK. Find the words that you do know and write the definitions for those words. This test will not count towards your grade in this class. Do not worry about correct spelling, but be sure to write a complete definition for the words that you do know. (Distribute a form of the Written Vocabulary Definition Device.)

Write your name, my name, and today's date at the top of the page. (Pause for approximately one minute. You may want to have that day's date and your name written on the board for the students to copy.) **There is no time limit for this test. Raise your hand when you have written the definitions for as many words as you can. Are there any questions?** (Answer any questions.) **Ready. Begin.** (Collect the papers when students finish writing definitions. Distribute the Matching Vocabulary Screening Device. Directions are on the test.)

(NOTE: Vary the beginning sentence for the 2nd and 3rd occasions that the students may take the screening device, i.e., "**Today you will be taking *another* test on definitions of vocabulary words.**")

Materials Needed for Instructional Implementation Weeks 1, 2, 3, and 4

1. Two cards for each of the example and target words for that week. Card 1 for each word will have the vocabulary word on one side and the keyword on the other side. Card 2 will have the vocabulary word, the keyword, the definition of the vocabulary word, and the interactive illustration printed on it.

2. A cassette recorder and timer to indicate lesson and daily evaluation lengths.

Advance Organizer - Day 1

(Begin tape in cassette recorder.)

Today I am going to help you learn the meanings of some vocabulary words. We will spend some time today, tomorrow, and the next day learning the meanings of these words. You will take a quiz at the end of each of these lessons to see how many you have learned, and then you will take a test on Thursday to see how many you have remembered. The test on Thursday will count towards your grade in this class. (Ask questions such as "What are we going to do today?" "When will you take the quiz?" "When will you take the test?" What will the Thursday test count towards?" Provide PEP when necessary.)

(NOTE: Vary the beginning sentence of the advance organizer for the second, third, and fourth weeks of instruction, i.e., **"This week we will *continue* to learn the meanings of some vocabulary terms."**)

In order to help you learn the meanings of these words, I want you to use a special method. The best

way to tell you about the method is to give you practice using it. We will practice three example words.

Demonstration - Day 1

(Show Card 1 for the first example word.) **Suppose I ask you to learn that the word say the word means state definition. There are two important steps to follow that will help you learn this. The first step is to learn a keyword, or word clue for the vocabulary word. The word clue is a word that sounds like some part of the vocabulary word. Listen carefully to the word, say the word. A good word clue for say the word is state keyword, or clue word.** (Show the other side of card 1.) **You know, like state meaning of the keyword, or clue word. OK. What is the word clue for say the word? Remember the meaning of the word say the word is state definition. The word clue is state keyword, or clue word.**

For the next step I will show you a picture that will help you remember the vocabulary word's definition. The picture will show you the word clue for the vocabulary word. This picture will also show you the word clue doing something with the definition of the vocabulary word. (Show the accompanying interactive illustration card 2 of the word.) **This picture shows describe the interactive illustration. The word clue for say the word is state keyword, or clue word. Remember this picture of describe the interactive illustration. Remember this picture of what?** (Prompt if necessary.) **Now, if**

you remember this picture of describe interactive illustration, you will remember later on that say the word means state definition.

Modeling - Day 1

Let's do another example. (Repeat the above procedure twice using a new example vocabulary word each time. Either call individual student names or have the class respond in unison to the question.)

1. **The next word we are going to study is say the word.**
2. **What is the next word,** (call student name)?
3. **The word clue for say the word is state keyword, or word clue.**
4. **What is the word clue for say the word,** (call student name)?
5. **Say the word means state definition.**
6. **What does say the word mean,** (call student name)?
7. **The way to remember that say the word means state definition is to think about this picture** (show interactive illustration) **of state keyword, or word clue doing describe interactive illustration with say the word.**
8. **What is state keyword, or word clue doing with say the word,** (call student name)?
9. **And what does say the word mean,** (call student name)?
10. **How do you remember that say the word means state definition,** (call student name)?

The word clues and pictures can help you to remember the meanings of each vocabulary word. Now let's use this method to learn the meanings of 12 other vocabulary words. Are there any questions? (Answer any questions.) **OK. Let's begin.**

Keyword Phase - Guided Practice - Days 1, 2, and 3

First you will learn the word clues for all the words. The word clue for say the word is state keyword, or word clue. (Read all words and flip cards once.) **Now, what is the word clue for say the word?** (Test three times and randomize the order by shuffling the cards each time.)

Study Phase - Continued Guided Practice - Days 1, 2, and 3

Now I will show you the pictures that will help you remember the meanings of the words. Remember that each of the pictures show the word clue that is doing something with the definition of the vocabulary word. I will give you time to study each picture. (Approximately 30 seconds/item. As picture is displayed, point and say--) **The word say the word, which sounds something like state keyword, or word clue, means state definition. Here is a picture of state what picture shows. What does say the word mean?**

Advance Organizer - Days 2 and 3

Today you will continue learning the definitions of some words. We will do this the same way that we did it yesterday. Remember, there is a 5 minute quiz at the end of today's lesson, and there will be

a test on Thursday. Let's start. (Proceed with the Keyword Phase and Guided Practice Phase.)

Evaluation - Daily

Our time for today's instruction on these words is over for today. Now you need to take the quiz. (Distribute a form of the Daily Measure of Vocabulary Definition Device.) **Write your name, my name, and today's date at the top of this page.** (Pause for approximately one minute. You may want to write that day's date and your name on the board so that the students can copy it.)

Follow along as I read the directions at the top of the page. Listen. Find the words that you know. Write the definitions next to the words.

I need to tell you one more thing about this quiz. Spelling does not count, but be sure to write a complete definition of the words that you do know.

You will have 5 minutes. Are there any questions? (Answer any questions.) **Ready. Begin.**

(Begin timer for 5 minutes. At the end of 5 minutes collect the students' papers. When appropriate, you may want to make a statement of praise regarding the students' behaviors and cooperation at the conclusion of each day's lesson and daily quiz.)

Evaluation - Weekly

Today you are going to take a test on the words you have been learning. (Distribute a form of the Written Vocabulary Definition Device.) **Write your name, my name, and today's date at the top of the page.** (Pause for approximately one minute. You may want to have

your name and that day's date written on the board for the students to copy.)

Now think about the pictures and try hard to remember the meanings of the words. On this test there may be words that you do not know or remember the meanings of; do not worry about them. Skip the words you do not know and find the words that you can define. Write the meanings of those words. Spelling does not count on this test, but be sure to write a complete definition of the words you know. There is no time limit for today's test.

Remember that today's test counts towards your grade in this class. Are there any questions? (Answer any questions.) **Ready. Begin.** (Collect the papers as the students are finished. Distribute a form of the Matching Vocabulary Definition Device after all students have completed the writing test. Directions for this assessment are written on the test. At the conclusion of the weekly evaluation you may want to make some statement of praise regarding the students' performance and cooperation during that week's instructional sessions.)

Terms, Keywords, and Interactive Illustrations

Example Terms for Week 1 - Animal and Plant Life

species - special
    a species of a special group of birds
hybrid - bird
    a mule is a hybrid of a donkey and a horse
predator - date her
    a cat wanting to date a mouse

Terms for Week 1

biomes - homes
    sillouette of homes around biomes
extinct - stink
    man holding his nose surrounded by extinct animals
fossil - old snails
    old snails picture among fossils
habitat - habit
    animals returning to their habitat as a habit
instincts - N (the letter)
    a duck nurturing ducklings and the letter N
niche - rich
    a rich woman pictured in different settings
stimulus - sting
    a man reacting to a bee that stings him
camouflage - camel
    a striped camel that is NOT camouflaged in the desert
flagellum - flag
    a flag that is attached to the whip on the flagellum
hypothesis - pot
    a pot that has ideas in it
velocity - city
    a motorcycle speeding through a city
respiration - rest
    a man in a lounge chair resting

Example Terms for Week 2 - Earth Science

epicenter - center
arrow pointing to the exaggerated center of an earthquake

catalyst - cat
a cat that is reacting to a chemical reaction

sediment - settle
sand settling at the bottom of a cup of water

Terms for Week 2

aquifer - fur
a fur coat soaking in an aquifer

crater - ate her
a crater with a female head at the top

crystal - cry
a person crying because crystal broke

cyclone - circle
exaggerated circles surrounding a cyclone

erosion - row boat
a row boat floating into the bank of erosion

leeward - lean
person leaning away from the wind

meanders - wanders
person wandering around the curves in a river

seismograph - size
person remarking on the size of an earthquake

sonar - sound
person listening for the sound waves

topographic map - top view
person looking down from the top at a map

diffusion - confusion
people spreading out in all directions due to fire

soluble - bubble
bottle of cola

Example Terms for Week 3 - Body Terms

vertebrae - vertical
emphasis on vertebrae that is vertical
trachea - key
key stuck in trachea
chromosomes - chrome
shiny chrome on chromosomes

Terms for Week 3

alveoli - eye
eye pictured as one of alveoli
artery - tree
tree growing out of artery
capillaries - pill
pill pictured as one of capillaries
esophagus - gut
emphasis on long tube connects to gut
ligaments - leg
leg that shows ligaments
medulla - dull
dull knife that does not cut you does not affect you
villi - fill
small intestin filled with villi
acoustic - stick
stick hanging out of ear
retina - Tina
projection from retina is a female, Tina
hormone - phone
hormones talking on the phone
cerebrum - broom
broom placed in cerebrum of brain
cerebellum - bell
bell placed below cerebrum in brain

Example Terms for Week 4 - Weather and Astronomy

incandescent - candle
candle that is glowing

cosmic - comic
comic book about the universe

ozone - prone
an O in prone position aborbing rays of sun

Terms for Week 4

anemometer - air meter
air meter that is used for anemometer

concave - cave
cave with emphasis on curve inward

condensation - coming down
arrows near droplets coming down

constellation - star relation
Big Dipper

evaporation - pour
pouring liquid from a tea kettle with steam pictured

galaxies - C's
the letter C as a part of a galaxie

nebulla - bull
a bull kicking up gas and dust in a nebulla

supernova - superman
superman exploding from a star

transparent - apparent
looking through shear curtains the view is apparent

eclipse - clip
a paper clip that is outlined during an eclipse

precipitate - sip
a person sipping from precipitation

translucent - cent
a cent that is visible through a window

APPENDIX J
SYSTEMATIC TEACHING WITH A SUBJECT-PROVIDED KEYWORD MNEMONIC CONDITION TEACHER SCRIPT

Directions for Vocabulary Screening Devices

Today you will be taking a test on definitions of vocabulary words. There are many words on these pages. You may not recognize many words, and you may not know the definitions for many words. That is OK. Find the words that you know and write the definitions for those words. This test will not count towards your grade in this class. Do not worry about correct spelling, but be sure to write a complete definition for the words that you do know. (Distribute a form of the Written Vocabulary Screening Device.)

Write your name, my name, and today's date at the top of the page. (Pause for approximately 1 minute. You may want to have that day's date and your name written on the board for the students to copy.) **There is no time limit for this test. Raise your hand when you have written the definitions for as many words as you can. Are there any questions?** (Answer any questions.) **Ready. Begin.** (Collect the papers when students finish writing the definitions. After students have completed the written screening, then distribute the Matching Vocabulary Screening Device. Directions for the matching assessment are written on the test.)

(NOTE: Vary the beginning sentence for the 2nd and 3rd occasions that the students may take the screening device, i.e., **"Today you will be taking *another* test on definitions of vocabulary words."**)

Materials Needed for Instructional Implementation Weeks 2, 3, and 4. (NOTE that the systematic teaching with teacher-provided keyword is implemented during the 1st week.)

1. Two cards for each of the example words for that week. Card 1 for each word will have the vocabulary word on one side and the keyword on the other side. Card 2 will have the vocabulary word, the keyword, the definition of the vocabulary word, and an interactive illustration printed on it.

2. One card for each of the targeted words for that week. Each of these cards will have the vocabulary word and definition printed on it.

3. Poster with the strategy steps for IT FITS.

4. Index cards (3" X 5") for students to use for writing vocabulary words and keywords.

5. A cassette recorder and timer to indicate lesson and daily evaluation lengths.

Advance Organizer - Day 1

(Begin tape in cassette recorder.)

Today I am going to help you learn the meanings of some vocabulary words. We will spend some time today, tomorrow, and the next day learning the meanings of these words. You will take a quiz at

the end of each of these lessons to see how many you have learned, and then you will take a test on Thursday to see how many you have remembered. The test on Thursday will count towards your grade in this class. (Ask questions such as "What are we going to do today?" "When will you take the quiz?" "When will you take the test?" "What will the Thursday test count towards?" Provide PEP when appropriate.)

(NOTE: Vary the beginning sentence of the advance organizer for the 2nd, 3rd, and 4th weeks of instruction, i.e., "This week we will continue to learn the meanings of some vocabulary terms.")

In order to help you learn the meanings of these words, I want you to use a special method on your own. The best way to tell you about the method is to give you practice using it. We will practice three example words.

Demonstration - Day 1

(Show card 1 for the first example word.) **Suppose I ask you to learn that the word say the word means state definition. There are two important steps to follow that will help you learn this. The first step is to learn a word clue for the vocabulary word. This word clue is a word that sounds like some part of the vocabulary word. Listen carefully to the word, say the word. A good word clue for say the word is state keyword, or word clue.** (Show both sides of card 1.) **You know, like state meaning of**

keyword, or word clue. OK. What is the word clue for say the word?

Remember the meaning of the word say the word is state definition. The word clue is state keyword, or word clue.

For the next step I will show you a picture that will help you remember the vocabulary term's definition. The picture will show you the word clue for the vocabulary term. This picture will also show you the word clue doing something with the definition of the vocabulary term. (Show interactive illustration card 2.)

This picture shows describe interactive illustration. The word clue for say the word is state keyword. Remember this picture of describe interactive illustration. Remember this picture of what? (Prompt if necessary.) Now, if you remember this picture of describe interactive illustration, you will remember later on that say the word means state definition.

Modeling - Day 1

Let's do another example. (Repeat the above procedure twice using a new vocabulary word each time.)

1. The next word we are going to study is say the word.
2. What is the next word, (call student name)?
3. The word clue for say the word is state keyword, or clueword.
4. What is the word clue for say the word,

(call student name)?

5. **Say the word means state definition.**

6. **What does say the word mean,** (call student name)?

7. **The way to remember that say the word means state definition is to think about this picture of** (show interactive illustration) **of state keyword, or word clue doing describe interactive illustration with say the word.**

8. **What is state keyword, or word clue doing with say the word,** (call student name)?

9. **And what does say the word mean,** (call student name)?

10. **How do you remember that say the word means state definition,** (call student name)?

(Read all words and flip cards once.) **Now, what is the word clue for say the word?** (Test three times and randomize the order by shuffling the cards each time.)

The word clues and pictures can help you to remember the meanings of each vocabulary word. Now I want you to use this method to learn the meanings of 12 other vocabulary words. In order to use this method on your own, you need to learn the steps involved. The steps are written on this poster. Are there any questions? (Answer any questions.)

Strategy Phase - Guided Practice - Day 1

You can learn how to make up your own word clues for vocabulary words that you do not know, and

imagine pictures of the word clues doing something with the vocabulary words just like someone did for the examples we just did together. I will teach you a strategy, which is a way for you to make up word clues and pictures on your own. The first thing you need to learn is to follow these steps (Show poster).

Identify the term.
Tell the definition of the term.

Find a keyword.
Imagine the definition doing something with the keyword.
Think about the definition doing something with the keyword.
Study what you imagined until you know the definition.

(Elicit from students that IT FITS is the way to remember the strategy steps.)

First, you will need to identify the term, or word, that you do not know. (Point to poster.) **I will be telling you those words.** (Ask students to answer-- **What do you do first,** (call student name)? **Who will be telling you the words,** (call student name)?

Then, you need to tell the definition of the term. (Point to poster.) **I will tell the definition, then we will talk about what the definition of the term would look like.** (Ask students to answer-- What do

we do next? What will we talk about? Give prompts, corrective feedback, and positive reinforcement when necessary.) **We do not have any pictures of the terms, so you will need to imagine a picture in your head of what the term means. Once we have completed those two steps, we have finished the IT part of this strategy.** (Review IT part.)

The next step is the really fun part, and you will work alone on the rest of these steps--the FITS steps. At first this might seem a little bit hard for you, but once you learn how to do these strategy steps it will be much easier.

"Find a keyword." (Point to poster.) **A keyword is a word clue. It is a word that sounds like the vocabulary term somehow. The keyword may be a rhyming word or a word that sounds like a part of the vocabulary term.** (Ask "What is a keyword?" Refer to example words and their keywords. Question students regarding the keywords for the example words and elicit how the keywords sounded like the vocabulary term.)

"Imagine the definition doing something with the keyword." (Point to poster.) **When we used the example words that I just showed you, pictures were shown to you of the term's definition doing something with the keyword.** (Refer to example words and interactive illustrations. Have students describe the interactive illustrations.) **Now, what we have to do for this step is to imagine a way that the keyword can interact with the term's definition. We won't have pictures to help us, except for the pictures that you imagine**

in your head. (Again, refer to examples and remind students of how keywords and definitions can interact. Question.)

"Think about the definition doing something with the keyword." (Point to poster.) **This is an important step in this strategy, because sometimes students only remember the keyword that goes with the term, but they do not remember the term's definition. It is important in this step that you think about, or imagine, the picture in your mind of the keyword doing something with the term's definition.** (Refer to examples. Question.)

"Study what you imagined until you know the definition." (Point to poster.) **This is the last step, and if you can do this step successfully then you have a good chance of remembering the term's definition for the quiz and the test. Again, it is very important that when you hear the vocabulary term, you think of the keyword. The keyword makes you think about the picture in your head of the keyword doing something with the term's definition, and that helps you to remember the definition of the term.** (Refer to examples. Question.)

(Review all strategy steps using questioning, corrective feedback, prompts, positive reinforcement, and reference to examples. Be sure to use the questioning, corrective feedback, prompts, positive reinforcement, and reference to examples during the entire instructional session.)

IT Phase

First you will learn the terms and definitions. When I tell you the terms and definitions, I want you to imagine what the definition looks like. Listen carefully, and think hard so you can get a picture of the definition in your mind. (Repeat these directions for the 12 target words for that week. Place cards on the chalkboard ledge or bulletin board so that all words are visible for students to refer to when they are doing the strategy steps.)

Good. Now that you are more familiar with the terms and have an idea in your mind of what the definitions look like, it is time to do the next part of the strategy--FITS.

FITS Phase

(Students work individually now. Distribute the 3" X 5" index cards so that students can write the term on one side and the keyword that they think of on the other side.)

You will do one term at a time now. Try to find at least two terms that you can think of a keyword for. The first term is say the word. You need to "Find a keyword for say the word". Think of a word you know that sounds something like say the word. That will be the keyword, or word clue for say the word. The keyword can be a rhyming word or a word that sounds like a part of say the word. You can use these cards to help you remember the keywords you find for each term.

(Begin to circulate and assist students while they are finding keywords and completing the FITS part. During this time you and each student may be doing whispering or talking in low voices so that other students are not hearing the keywords for the students you are assisting at that time. The rest of the script will be read individually to each student to encourage the use of FITS. Repetition of the FITS to the whole class may be warranted at times.)

OK. Now you need to "Imagine the definition doing something with the keyword". What is the definition of <u>say the word</u>? What is the keyword for <u>say the word</u>? How can the definition and keyword for <u>say the word</u> do something together? (Circulate and assist students individually.)

All right. You are half-way through the strategy now, and next you need to "Think about the definition doing something with the keyword". What are you thinking about? (Circulate and assist students. Make sure that the keyword, the vocabulary term, and the imagined interaction accurately includes the term's definition. Have students whisper their interactions to you. PEP.)

You are almost through with this term. The last step of the strategy is to "Study what you imagined until you know the definition". What is the definition of <u>say the word</u>? Is what your keyword and term are doing together helping you to remember the definition? (If not, PEP to encourage an appropriate keyword and imagined interactive picture. DO NOT give

keywords or interactive picture ideas to the students. The students MUST find and imagine these on their own.)

Advance Organizer for Days 2 and 3

Today you will continue to use the IT FITS strategy to help you learn the definitions of the terms you are studying this week. (Review the strategy steps. Distribute index cards to the students. Review the 12 terms for that week and display them on the chalkboard ledge or on a bulletin board so that students can refer to them while they are completing the FITS part of the strategy.)

Study Phase and Continued Guided Practice for Days 1, 2, and 3

(Continue with IT and FITS until all terms have keywords and imagined interactive pictures. Allow students to write the vocabulary terms and keywords on opposite sides of index cards if they think that will help them to remember the keywords. Do not allow students to draw pictures--the interactive pictures must be imagined by the students.)

Evaluation - Daily

Our time for today's instruction on these words is over. Now you need to write as many definitions as you can remember. (Distribute a form of the Daily Measure of Vocabulary Definition Device.) **Write your name, my name, and today's date at the top of this page.** (Pause for approximately 1 minute. You may want to

write that day's date and your name on the board so that the students can copy it.)

Follow along as I read the directions at the top of the page. Listen. Find the words that you know. Write the definitions next to the words.

I need to tell you one more thing about this quiz. Spelling does not count, but be sure to write a complete definition of the words that you do know.

You will have 5 minutes. Are there any questions? (Answer any questions.) **Ready. Begin.**

(Begin timer for 5 minutes. At the end of 5 minutes collect the students' papers. When appropriate, you may want to make a statement of praise regarding the students' behaviors and cooperation at the conclusion of each day's lesson and daily quiz.)

Evaluation - Weekly

Today you are going to take a test on the words that you have been learning. (Distribute a form of the Written Vocabulary Definition Device.) **Write your name, my name, and today's date at the top of the page.** (Pause for approximately 1 minute. You may want to have your name and that day's date written on the board for the students to copy.)

Now think about the pictures you imagined and try hard to remember the meanings of the words. On this test there are words that you may not know or remember the meanings of; do not worry about them. Skip the words you do not know and find the words that you can define. Write the meanings of those

words. Spelling does not count on this test, but be sure to write a complete definition of the words you do know. There is no time limit for today's test.

Remember that today's test counts towards your grade in this class. Are there any questions? (Answer any questions.) **Ready. Begin.** (Collect the papers as the students are finished. Distribute the Matching Vocabulary Definition Device after all students have completed the written test. At the conclusion of the weekly evaluation you may want to make a statement of praise regarding the students' performance and cooperation during that week's instructional sessions.)

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BIOGRAPHICAL SKETCH

Margaret Elaine King-Sears was born on October 19, 1955, in Waco, Texas. She lived in Canada, Alabama, and then her family settled in Valdosta, Georgia, in 1963.

Margaret graduated from Valdosta High School and Valdosta State College. Her degree from Valdosta State College was a Bachelor of Science in Education and her field in education was special education with emphasis on mental retardation. She earned this degree in 1977, and then began teaching in Jacksonville, Florida. Between 1977 and 1981, Margaret taught educable mentally handicapped students in a self-contained elementary classroom and learning disabled and emotionally handicapped students in a resource secondary school. During this time she earned her Master of Science in Education in the field of special education, and she also became certified in teaching learning disabled and emotionally handicapped students.

The Department of Defense Dependents Schools (DoDDS) employed Margaret from 1981 until she began her doctoral studies in 1986. While working for DoDDS, Margaret taught varying exceptionalities in elementary and secondary schools in Schweinfurt, Germany, and in Okinawa, Japan. She began

her doctoral program at the University of Florida in Gainesville, Florida, in 1986. Her Ph.D. major is in special education with emphasis on mildly handicapped students, and her minor is in Instructional Design.

Margaret will be employed by Johns Hopkins University as an adjunct faculty member when she graduates from the University of Florida. She will be relocating to Washington, D.C.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Cecil D. Mercer

Cecil D.Mercer, Chair
Professor of Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Paul T. Sindelar

Paul T. Sindelar
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Vivian I. Correa

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 1989

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